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13. ABSTRACT *(Maximum 200 Words)*

The Embedded Mission Planning and Integrated Rehearsal effort was initiated by DARPA and STRICOM as an exploratory sampling and analysis of warfighting planning processes and tools. The purpose of this effort was to identify highly promising technologies and tools to facilitate embedding a mission rehearsal capability robust enough to train a target audience on a set of target tasks within the broad range of mission rehearsal environments. Observations and recommendations in this report are based upon the sampling of current planning practices and expected future requirements as articulated in Joint Vision 2010. Nothing in this report should be construed as impacting doctrine.

Specific tasks were (1) to define the mission rehearsal environment; (2) to identify applicable technologies and tools; (3) to assess the maturity and applicability of those technologies and tools; and (4) to provide technology recommendations for demonstrating a prototype system to meet capability shortfalls. Follow-on efforts have been recommended to further define and demonstrate selected methods and means to interface with command, coordination, and intelligence systems to enhance commanders' preparations to decisively control the battlespace.

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EXECUTIVE SUMMARY

The Embedded Mission Planning and Integrated Rehearsal effort was initiated by DARPA and STRICOM as an exploratory sampling and analysis of warfighting planning processes and tools. The purpose of this effort was to identify highly promising technologies and tools to facilitate embedding a mission rehearsal capability robust enough to train a target audience on a set of target tasks within the broad range of mission rehearsal environments. Observations and recommendations in this report are based upon the sampling of current planning practices and expected future requirements as articulated in Joint Vision 2010. Nothing in this report should be construed as impacting doctrine.

Specific tasks were (1) to define the mission rehearsal environment; (2) to identify applicable technologies and tools; (3) to assess the maturity and applicability of those technologies and tools; and (4) to provide technology recommendations for demonstrating a prototype system to meet capability shortfalls. Follow-on efforts have been recommended to further define and demonstrate selected methods and means to interface with command, coordination, and intelligence systems to enhance commanders' preparations to decisively control the battlespace.

The focus of this effort is on supporting the next generation of command, coordination and intelligence systems that are envisioned by Joint Vision 2010. The goal is for commanders and staffs at many echelons to, rapidly and effectively, conduct Joint and Service operational mission planning, rehearsal, and execution monitoring.

The body of the report includes:

- Summaries of planning processes at the Joint (Unified Command and Joint task force) and Army staff levels (Sections 4 and 5). These encompass a range of echelons, all of which share stated requirements for similar planning and rehearsal activities.
- A discussion of Joint Vision 2010 (Section 6), which provides insight into the concepts and mission environments which any future capabilities must support.
- Interview summaries (Section 7), including background information and discussions of other systems and technologies which were cited as relevant during those interviews.
- A discussion of lessons learned and a proposed follow-on approach (Section 8).

A significant portion of the total effort involved interviews with key personnel who were working on projects relevant to the purpose of this study. The interviews conducted constituted a prioritized subset of a very long list of applicable candidates, given the broad scope of the study area.

Three major conclusions resulted from the analysis of research and interview data:

1. Very few computer-based tools exist for Joint planning and rehearsal.
2. Applicable tools which do exist usually have been designed for a very specific domain and therefore do not allow easy reuse or adaptation.
3. Most tools in this domain are not interoperable, since they typically were designed only for use at specific sites.

The follow-on plan recommends a five-year effort that will begin with additional research, further requirements analysis, and some immediate prototyping of basic Joint planning tools. A team

composed of DARPA and STRICOM members, the DARPA COAA program, the Army's Centralized Test Support Facility at Fort Hood, USACOM, the Armed Forces Staff College, DoD Joint planning SMEs, and appropriate Industry, is recommended for the follow-on efforts. There is a definite need for tools supporting Joint planning and mission rehearsal functions, and a general approach to additional work should include the following tasks:

- Design and implement basic Joint planning tools that are designed to mesh with existing C2 systems.
- Explicitly plan interfaces between the basic tools and C2 systems.
- Implement the interfaces to C2 systems. Leading candidate C2 and rehearsal systems include MCS, WARSIM, and the DARPA COAA programs.
- Enhance all interfaces and tools as required based on testing and experimentation
- Demonstrate the entire tool set in a Joint military exercise
- Investigate and implement advanced embedded training concepts for these Joint tools using computer based testing, automated scenario generation, and personal training devices

The major benefits include:

- Creation of Joint tools and an integrated system that covers planning, rehearsal, and execution monitoring tasks across multiple echelons.
- Creation and use of an experimental system to integrate existing and new tools.
- Providing a leave behind capability for further experimentation.
- Providing a prototype for future system development and production.

1. PURPOSE

This final report embodies the results of work under ADST II Delivery Order 0092, Embedded Mission Rehearsal Analysis. The stated goal of this data collection and analysis effort (as specified in the Statement of Work) was "to identify the critical technologies/tools necessary to facilitate embedding a mission rehearsal capability that is robust enough to train a target audience on a set of target tasks within the broad range of mission rehearsal environments". The specific tasks were: (1) to define the mission rehearsal environment; (2) to identify applicable technologies and tools; (3) to assess the maturity and applicability of those technologies and tools; and (4) to provide technology recommendations for demonstrating a prototype system to meet capability shortfalls.

The body of the report includes:

- Summaries of planning processes at the Joint (Unified Command and Joint task force) and Army staff levels (Sections 2 and 3). These encompass a range of echelons, all of which share stated requirements for similar planning and rehearsal activities.
- A discussion of Joint Vision 2010 (Section 4), which provides insight into the concepts and mission environments which any future capabilities must support.
- A discussion of lessons learned and a proposed follow-on approach (Section 5).

2. JOINT OPERATION PLANNING

2.1. INTRODUCTION

The "Joint operation planning process" is defined in the DoD Dictionary (JCS Pub 1-02) as a "coordinated Joint staff procedure used by a commander to determine the best method of accomplishing assigned tasks and to direct the action necessary to accomplish the mission." Two types of planning procedures are defined: "deliberate planning procedures," used when time is not a critical factor, and "crisis action procedures" (CAP), used when a requirement to deploy and/or employ military forces may be imminent. Both types involve these general tasks:

- Receive and analyze the task to be accomplished.
- Review the enemy situation and begin to collect necessary intelligence.
- Develop and compare alternative courses of action.
- Select the best alternative.
- Develop and get approval for its concept.
- Prepare a plan.
- Document the plan.

The authoritative descriptions of both the deliberate and crisis action planning procedures are provided in the Joint Operation Planning and Execution System (JOPES) publications, CJCSM 3122.01 through 3122.04. The Joint Staff Officer's Guide (AFSC Pub 1), published by the Armed Forces Staff College, is a standard reference on these and related subjects. This discussion is derived primarily from Chapters 5-7 of the 1997 edition of AFSC Pub 1.

2.2. DELIBERATE PLANNING

Deliberate planning may be either "requirements planning" or "capabilities planning." Requirements planning focuses on the enemy threat and assigned task and derives the force levels and support needed, whether currently available or not. Capabilities planning addresses the threat using forces, equipment, and supplies which are available now or expected to be available during the planning cycle.

Deliberate planning from a strategic/global perspective occurs primarily at the NCA/JCS level. Planning for regional contingencies is the task of the five Unified Commands with geographic areas of responsibility (Atlantic, European, Pacific, Central, and Southern Commands). Such contingencies are identified as either "Major" or "Lesser" Regional Contingencies (MRCs or LRCs). MRCs involve significant threats to U.S. interests requiring a significant deployment of forces (more than a division/wing combination). The tasking of Unified Commanders to plan for particular MRCs and LRCs within their areas of responsibility is set forth in the biennial Joint Strategic Capabilities Plan (JSCP), issued by CJCS to set forth the military strategy which supports the overall national security strategy developed by the National Security Council. Unified Commands with functional responsibilities (Transportation, Special Operations, Strategic, and Space Commands) participate in deliberate planning primarily as supporting commanders to the regional Commander in Chief (CINC).

A major contingency plan must address:

- Mobilization planning, including necessary activation of Reserve forces.
- Deployment planning, covering all aspects of movement of forces and materiel from home station to destination within the theater of employment.
- Employment planning, addressing the use of forces within the theater.
- Sustainment planning, addressing the logistic support of those forces.
- Civil engineering planning, to develop or repair required facilities.
- "Retrograde" planning to address noncombatant evacuation operations (NEO) and medical evacuation.

The JCS, as specified in the JSCP, have adopted the concept of "adaptive planning" for developing regional contingency plans. Adaptive planning involves providing a range of crisis response options to a particular contingency. This facilitates giving the NCA a choice of options should the contingency actually occur, provides a rational basis for planning for simultaneous contingencies in different regions, and makes it more likely that a plan can be readily adapted to producing an Operation Order (OPORD) if required. The options under adaptive planning include a range of "Flexible Deterrent Options". These options consist of comprising diplomatic, economic, and informational (as well as military actions), a "Deploy-Decisive-Force" option for use if deterrence fails or warning of imminent hostilities occurs, and a "Counterattack" option for use if an attack occurs prior to any U.S. deployment actions under other options. Specific sets of forces are apportioned (declared available for planning) to the CINC for each option: Case 1 forces for Flexible Deterrent Options, Case 2 and 3 forces for initial and later deployers respectively under the Deploy-Decisive-Force option, and Case 4 forces to ensure a quick end to the conflict under either the Deploy-Decisive-Force or Counterattack options. The higher the "Case," the less likely it is that all allocated forces will actually be available if a prior MRC has occurred in another region.

The phases of deliberate planning, and the associated specified steps within each phase, are described below. Although specified by JCS, these are guidelines, used to develop required planning products.

Initiation Phase:

Each Unified Command CINC is assigned planning tasks in the biennial JSCP. Other planning tasks (e.g., for noncombatant evacuation, disaster relief, or the security of forces and installations in the area of responsibility) are inherent in the CINC's regional or command responsibilities as defined in the current Unified Command Plan and in JCS Pub 0-2, "Unified Action Armed Forces."

The JSCP tasking specifies whether a given planning task involves an operation plan in complete format (OPLAN), an operation plan in concept format (CONPLAN), or a Functional Plan. A CONPLAN usually does not include the detailed identification of units and equipment and the elaborate movement planning embodied in an OPLAN and its associated Time Phased Force Deployment Data (TPFDD) file; nor is it usually required to include all of the detailed annexes typical of an OPLAN. A CONPLAN is usually associated with a contingency which is considered a lesser threat to U.S. interests, or unlikely to stress U.S. capability to respond, or relatively unlikely to occur within the period covered by the planning cycle. A Functional Plan is also limited in detail and normally addresses operations in a peacetime or "permissive" context, including disaster relief, surveillance, and logistics.

The JSCP also identifies the notional major combat forces (Army brigades, USAF squadrons, Navy carrier battle groups, Marine Air/Ground Task Forces, etc.) and strategic transportation assets apportioned for planning purposes.

Concept Development Phase:
This phase involves development of a CINC's Strategic Concept which, when reviewed and approved by CJCS, becomes the concept of operations for the plan.

Step 1: Mission Analysis
Based on the assigned planning task and apportioned forces, the commander develops a mission statement—a "clear, concise statement of the objective to be accomplished by the command (what) and the purpose to be achieved (why)."

Step 2: Planning Guidance
Information is provided to the commander's staff to enable work to begin on developing possible courses of action; similar information is imparted to subordinates commanders via a Planning Directive document or a planning conference. This information may include:

- The mission statement.
- The commander's intent—a statement of the desired "end state," particularly as it may relate to a transition to future operations.
- Assumptions, defined as "suppositions on the current situation or presuppositions on the future course of events, assumed to be true in the absence of positive proof, necessary to enable to commander to complete an estimate of the situation and make a decision on the course of action." Assumptions should be logical, realistic, and essential for planning to continue. They may concern both the friendly and enemy situations but should never "assume away" an enemy capability.
- Political considerations impacting planning.
- Tentative Course of Action (COA)s being considered by the commander.
- A planning schedule and initial briefings.

Step 3: Staff Estimates
Each staff section participates in the process of analyzing tentative courses of action. This is likely to be a continuing, iterative process as the set of COAs under consideration is revised, with individual COAs added, rejected, refined, or modified. A staff estimate is an evaluation of the mission from an individual functional perspective (personnel, operations, logistics, C4, etc.) which includes an analysis and comparison of proposed COAs and a recommendation as to which COA can best be supported. The intelligence staff estimate examines the enemy situation and capabilities, analyzes the possible enemy COAs available, and determines the most likely actual enemy course of action.

Step 4: Commander's Estimate
The Commander's Estimate is a planning document which is prepared (normally by the J-5 staff) to describe the COA chosen by the commander and the reasoning behind that choice. It draws upon the previously prepared staff estimates and serves as additional guidance for the staff and subordinate commanders. The basis structure of the document is:

1. Mission

2. Situation and Courses of Action

    a. Considerations affecting the possible courses of action
        (1) Characteristics of the area of operations
        (2) Relative combat power
    b. Enemy capabilities
    c. Own courses of action

3. Analysis of Enemy Capabilities

4. Comparison of Own Courses of Action

5. Decision

The courses of action described are those which were evaluated by the staff as meeting the prescribed tests for adequacy (accomplishes the mission), feasibility (uses available resources), acceptability (in terms of cost, possible losses, time, etc.), variety (each COA is "substantially different"), and completeness (fully described).

Step 5: CINC's Strategic Concept
The CINC's Strategic Concept is a thorough description of the concept of operations to fulfill the mission, and is basically an expansion upon the description of the chosen COA in the Commander's Estimate. The basic structure is:

1. Situation
    - Probable preconditions for implementation
    - Deterrent options included in plan
    - Enemy forces
    - General tasks of friendly forces
    - Expected operations of other friendly commands that will influence plan
    - Assumptions, including level of mobilization
    - Legal considerations

2. Mission
    - Objectives to be accomplished

3. Execution
    - What forces will be employed
    - Where forces will be employed
    - When forces will be phased into theater
    - How forces will be employed (general description)
    - Conventional, nuclear, and other supporting operations
    - Deception
    - Necessary deployment of forces
    - Tasks of each subordinate and supporting command
    - Required supporting plans

4. Administration and Logistics
   - Transportation during deployment and employment
   - Concept of logistics support

5. Command and Control
   - Command relationships
   - Command and control requirements
   - Succession to command

The CINC's Strategic Concept is provided to CJCS for review and approval, and to subordinate and supporting commands for their use during development of the CINC's plan and their supporting plans as assigned. For major plans, a concept development conference may be held with representation from these commands.

Step 6: CJCS Concept Review
The Joint Staff, on behalf of CJCS, conducts a review of the concept, obtaining inputs from the Services and designated agencies (National Security Agency, National Imagery and Mapping Agency, Defense Logistics Agency, and Defense Information Systems Agency). Comments are categorized as execution-critical (requiring changes to the concept), substantive (requiring correction in the course of plan development), or administrative (errors in terminology, citation of references, etc.). Once approved, the CINC's concept becomes the basis for the "Execution" paragraph and Annex C (Operations) of the operation plan.

Plan Development Phase:
This phase involves the expansion and documentation of the concept of operations in the prescribed format (OPLAN, CONPLAN, or Functional Plan). For an OPLAN, the most complex case, the steps are as follows; they may overlap or be repeated as circumstances dictate. Various Joint Operation Planning and Execution System (JOPES) application programs, available through the Global Command and Control System (GCCS), are used to create and access the Time-Phased Force and Deployment Data (TPFDD) file. The TPFDD file identifies required forces and supplies in terms of initial location, ports of embarkation and debarkation, destination, required deployment date, and physical characteristics affecting transportation.

Step 1: Force Planning
This step is primarily performed by Service Component Commanders subordinate to the CINC. The CINC's Strategic Concept identifies the major combat forces to be used, which are limited to those already under the CINC's combatant command or apportioned by the JSCP or other tasking document. Based on the relevant planning documents and other guidance from their specific Services, the component commanders expand these major combat forces into a total force list including all required combat, combat support, and combat service support units. The force list is "time-phased": working backwards from the date each unit is required to arrive at destination, various other dates for mobilization, assembly at point of origin, and arrival at ports of embarkation and debarkation are identified. The force list may be somewhat "notional" and generic at the start at the start; pre-developed "force modules," associated with major combat forces but also including required CS and CSS units as well as initial supply sustainment for some specified period, are used if available. Such force modules may be Service developed or OPLAN-dependent; the latter type is a derivative of a Service force module, adapted to the needs of a particular theater and mission.

Step 2: Support Planning
Support planning involves determining the amount of supplies, equipment, and replacement personnel required in sustaining the forces associated with the plan and phasing their arrival in theater to support the concept of operations. The concept of support in included in the overall concept of operations; important considerations include the length of the operation, the availability of strategic lift, available air and sea "ports of support," supply buildup policy, and attrition factors.

Supplies and equipment are categorized as unit-related or non-unit-related. Unit-related supplies include a "basic load," already included in the Service description of each unit, and "additional accompanying supplies" as required to make the unit self-sustaining for the period specified by the CINC. Non-unit-related supplies may include pre-positioned stocks as well as all subsequent re-supply. Important issues include: (1) the need, as specified by the CINC, to achieve a "supply buildup" in theater of some number of days of resupply in anticipation of any possible interruption in the resupply pipeline and (2) the need for an initial flow of "sustaining supplies," usually delivered by air, prior to the establishment of a continuous resupply capability usually associated with sealift.

Step 3: NBC Defense and Nuclear Planning
These areas are addressed somewhat separately. A separate TPFDD addresses NBC defense requirements. Nuclear planning is largely accomplished by the U.S. Strategic Command—in coordination with regional CINCs.

Step 4: Transportation Planning
Transportation planning is an iterative process, also involving Step 5 below, beginning when all force and non-unit-related supply information has been specified in the TPFDD and culminating in a feasible strategic lift schedule, as demonstrated by a computer model. It is conducted by the supported CINC's staff in coordination with the U.S. Transportation Command. Identification by the Service component commanders of specific forces to replace notional units in the TPFDD, a process called "sourcing," occurs largely during this phase and is influenced by it (e.g., by the selection of best ports of embarkation). (Most Navy forces are not sourced in deliberate planning, since the availability of specific units at any time in the future is dependent on deployment schedules; such forces in any case place few if any demands upon strategic lift assets.)

Step 5: Shortfall Identification
Wherever the movement schedule fails to deliver forces or supplies in time to support the CINC's concept of operations, a "shortfall" is said to exist. Planners may repeatedly adjust the movement plan as required to correct shortfalls as they are identified. The CINC, however, must approve any changes impacting the concept of operations or concept of support. Shortfalls beyond the CINC's capability to resolve are reported to CJCS with an assessment of their impact and any recommendations (possibly including changes in the original task assignment).

Step 6: Transportation Feasibility Analysis
This step culminates in the CINC's determination that the OPLAN is "grossly transportation feasible": sufficient strategic lift capability and sufficient throughput capability at ports of embarkation and debarkation are apparently available to support the mission and concept of the plan.

Step 7: TPFDD Refinement
This "step" may actually be conducted concurrently with force planning and subsequent steps. However, final iterations are associated, in the case of major OPLANs, with formal conferences involving USTRANSCOM, the Services, the Defense Logistics Agency, and the Joint Staff in

addition to the staff of the supported CINC responsible for the plan. This process involves three successive steps:

- Forces refinement: The sourcing of forces is completed, with verification that data used by JOPES applications, such as force module descriptions, individual unit data, and logistics and civil engineering planning factors, is up to date.

- Logistics refinement: Involving primarily the Defense Logistics Agency, Service logistics agencies, Service component commands, and USTRANSCOM, this step includes verifying that planning factors are correct and mutually agreed, examining the sourced logistics requirements for adequacy and correctness, and resolving any shortfalls.

- Transportation refinement: This step is accomplished by USTRANSCOM, which coordinates the final resolution of transportation related problems and assesses gross transportation feasibility after completion of forces and logistics refinement.

Upon completion of TPFDD refinement, the OPLAN may be designated "effective for planning," based on its approved concept and transportation feasibility; as such, it could be used as a basis for execution if required.

Step 8: Plan Documentation

This step involves completion of a completely documented plan in standard format, including a summary, a basic plan, annexes, and appendices. The CINC's Strategic Concept provides a basis for beginning this step, but completion must await the conclusion of TPFDD refinement, the process of which may impact the concept as originally envisioned. The basic plan generally follows the format of the CINC's Strategic Concept, but most details are replaced with references to the appropriate detailed annexes, which include:

Annex A. Task Organization
Annex B. Intelligence
Annex C. Operations
Annex D. Logistics
Annex E. Personnel
Annex F. Public Affairs
Annex G. Civil Affairs
Annex H. Environmental Services
Annex J. Command Relationships
Annex K. Command, Control, and Communications Systems
Annex L. Operations Security
Annex M. Mapping, Charting, and Geodesy
Annex N. Space Operations
Annex P. Wartime Host Nation Support
Annex Q. Medical Services
Annex R. Chaplain Activities
Annex X. Execution Checklist
Annex Z. Distribution

The TPFDD is considered an integral part of the OPLAN; a printed extract called the Time-Phased Force and Deployment List (TPFDL) is normally included as Appendix 1 to Annex A.

Plan Review Phase:
Review of the completed OPLAN is conducted by the Joint Staff for CJCS. The plan is evaluated with regard to adequacy (satisfying the task assignment), feasibility, acceptability (in terms of cost, expected losses, or other criteria), and consistency with Joint doctrine. Comments are provided to the supported CINC, who is required to address those identified as execution-critical prior to CJCS approval.

Support Plans Phase:
The requirement for supporting plans is determined by the supported commander. Such plans are normally required of Service component commanders and identified Joint Task Force commanders. They are to be submitted to the supported commander for review within sixty days of CJCS approval of the supported plan, which in reality dictates that their preparation must proceed in conjunction with development of the supported plan. Supporting plans normally need not repeat information in the supported plan. These plans tend to focus on employment planning which may be difficult to accomplish when the precise situation (which could trigger plan execution) is unknown. Detailed employment planning is therefore often deferred in the case of major OPLANs. Supporting plans generally use the same Plan Identification Number (PID) as the supported plan, although some commanders may prepare "omnibus" plans which support several different plans and which have a distinctive unique PID.

An approved plan is reviewed regularly to determine if its concept remains valid with respect to current real-world conditions. Any need for major changes in the concept may dictate completion of a new cycle through the deliberate planning process. As a separate procedure, and at more frequent intervals, the plan's TPFDD file is regularly updated ("TPFDD Maintenance") to reflect changes in force structure and other factors affecting the sourcing of units and sustainment.

2.3. CRISIS ACTION PLANNING

Crisis Action Planning procedures are described in CJCSM 3122.01. CJCSM 3122.01 defines a crisis as:

> *An incident or situation involving a threat to the United States, its territories, citizens, military forces, possessions, or vital interests that develops and creates a condition of such diplomatic, economic, political, or military importance that commitment of U.S. military forces and resources is contemplated to achieve national objectives.*

The deliberate planning process is used to develop responses to a limited set of critical situations: those which are particularly important to national security, involve a major commitment of resources, and/or are considered relatively probable to occur in the near term. The situation addressed in each case is hypothetical and unlikely to occur in precisely the matter envisioned; furthermore, the forces, supply sustainment resources, and transportation apportioned and sourced for the plan may for various reasons not be available when a corresponding real-world situation occurs. For these reasons, a crisis response is never as simple as "executing an OPLAN" as written.

A crisis is characterized by:

- A dynamic situation, and a constantly changing and expanding body of knowledge.
- A need for simultaneous activity within, and coordination among, multiple levels of command including the National Command Authority, who must approve all major actions including the deployment and employment of forces.

- A need for operations security which may at least temporarily limit participation by some commands and agencies.

The defined phases of Crisis Action Planning are described below. The end of a phase, or the commencement of the next, is usually associated with a decision point and associated orders or directives. In an actual, time-critical situation, certain phases may be compressed, performed concurrently, or eliminated and the messages described in connection with these phases (prior to the Execute Order) may never be formally issued. A great deal of coordination, guidance, and advance warning of impending tasking may be accomplished by only voice communication. A crisis may, of course, be resolved prior to completion of all phases, or a military response may be deemed inappropriate at some point in the NCA decision making process.

Situation Development Phase:
This phase is characterized by the observation and reporting of an event assessed as out-of-the-ordinary and having a potential adverse impact on the national interest or security. The National Military Command Center in Washington DC is the DoD focal point for situation monitoring, and it maintains communications with the State Department, the White House Situation Room, intelligence agencies, and various other government entities. In addition, it also maintains communications with the Unified Commands, Services, defense agencies, and the Office of the Secretary of Defense. Reporting of a significant event by a military activity is accomplished by an "OPREP-3 PINNACLE" or Critical Intelligence Report (CRITIC) message, possibly sent initially as a voice report. Such reports are made directly to the NMCC, with other addressees as appropriate. Additional update reports may follow. The CINC in whose Area of Responsibility the event occurred (supported CINC) provides an "OPREP-3 PINNACLE/CINC's ASSESSMENT" report, which may include information on action being taken under existing rules of engagement, forces available, major constraints on employment of forces, and courses of action under consideration or recommended.

Crisis Assessment Phase:
The major activity characterizing this phase is at the NCA and JCS level, where the determination may be made to develop a military option in response to the crisis. Monitoring of the situation continues at other levels by all concerned; the NMCC, Joint Staff, and supported and supporting CINCs (including USTRANSCOM) will likely establish special teams (Battle Staffs, Crisis Action Teams, etc.) to monitor the situation and conduct required planning. The supported CINC continues to provide situation reports and assessments, and conducts operations as required and permitted under current ROE. Beginning in this phase, and at any point thereafter, the CJCS may (as authorized by the Secretary of Defense) issue a Deployment Preparation Order or Deployment Order to alert forces of possible deployment; actually order such deployment to commence; establish a new Joint Task Force; or otherwise signal U.S. readiness to take military action. Transition from this phase to the next occurs when the NCA actually authorizes development of a military option.

Course of Action Development Phase:
This phase begins with issuance by CJCS of a Warning Order in response to the NCA decision to plan for a military response to the developing crisis. The Warning Order, and all subsequent tasking messages, may include deployment preparation or deployment orders, in which case specific approval of the Secretary of Defense is required. The Warning Order is the counterpart of the Planning Directive in deliberate planning and includes:

- Description of the situation.
- Assumptions for planning.

- Mission statement and CINC-level tasking assignments
- Forces and transportation assets allocated for planning
- Reference to relevant OPLANs and CONPLANs
- Command relationships, identifying the supported CINC, supporting CINCs (normally USCINCTRANS and those regional CINCs who would contribute deploying forces), and other supporting agencies.
- Request for the supported CINC to respond with alternative COAs for NCA consideration. Any specific COAs under current consideration at the JCS/NCA level will be described.
- Tentative/anticipated dates for commencement of mobilization (M-day), deployment (C-day), and operations (D-day) as appropriate.
- Other guidance and instructions (e.g., public affairs and communications) as appropriate.

Time permitting, the supported CINC may involve his Service component and supporting commanders in COA development by submitting an OPREP-1 Commander's Evaluation Request message. Specific support requested may include evaluation of proposed COAs, submitting force and support requirements, or providing information in support of the CINC's recommended COA. The corresponding response format is the OPREP-1 Evaluation Response. USTRANSCOM may be tasked to provide an OPREP-1 Deployment Estimate to the supported CINC which includes a force closure estimate for each COA and the planning factors used to arrive at those estimates.

It may be possible to develop tentative COAs by adapting an existing OPLAN or further developing an existing CONPLAN. JOPES ADP applications support the modification or building from scratch of force lists and support packages, essential for evaluating the feasibility of a COA with respect to the timely deployment of required forces. Determining the adequacy and relative merit of COAs from other aspects is less well supported. To quote AFSC Pub 1: "An objective, comprehensive evaluation of proposed COAs is difficult even without time constraints. Some combatant commands are developing computer simulations to assist in measuring sensitivity of COAs to key parameters."

The supported CINC's formal response to the Warning Order is the OPREP-1 Commander's Estimate, a brief and concise counterpart to the Commander's Estimate in deliberate planning procedures. It includes paragraphs on the mission, situation, courses of action, analysis of enemy capabilities versus the COAs, comparison of own COAs, and recommendation as to the best COA. Remarks on the location of various JOPES planning files within GCCS and information concerning planning factors used are normally included.

Course of Action Selection Phase:
CJCS, assisted by the Joint Staff and in consultation with the other members of JCS, reviews the CINC's recommended COAs and presents COA recommendations to the NCA. During this phase, CJCS may on his own initiative issue a Planning Order which directs execution planning for a specified COA and submission of an OPORD by a specified date and time. The Planning Order follows a format similar to the Warning Order but does not repeat information previously provided. When an affirmative NCA decision on a COA is received, CJCS issues an Alert Order, again similar to the Warning or Planning Order, without duplicated information and clearly stating Secretary of Defense authorization for execution planning.

Execution Planning Phase:
Efforts in this phase focus on preparation of the supported CINC's Operation Order and the OPORDs of the subordinate and supporting commanders. The Services and the CINC's component commanders clarify the sourcing of forces, USTRANSCOM applies its assets to transportation requirements in order

to develop airlift and sealift schedules for deployment and movement channels for sustainment; a TPFDD in support of the OPORD is developed using JOPES ADP. (As a practical matter, most effort is expended on refining the first 7 days of airlift and 30 days of sealift or surface movement. Refinement and rescheduling farther into the future can be accomplished day-by-day upon execution.) The forces identified for deployment or deployment support report their progress toward attainment of various stages of "deployment posture" via prescribed Situation Reports (SITREPs).

The supported CINC's OPORD, as well as other supporting OPORDs, are reviewed for adequacy and feasibility by CJCS, who provides additional guidance and direction as required. The OPORD, promulgated in message format, includes:

- Task Organization - Supporting and subordinate commands and major force elements (identified as accurately as current sourcing permits).
- Situation, including enemy forces and friendly forces not directly involved in the operation.
- Mission statement – Objectives to be accomplished.
- Execution - A brief statement of the concept of operations, task assignments for each subordinate or supporting command, and coordinating instructions such as applicable ROE and anticipated execution date (D-day).
- Administration and Logistics - Usually only notes any differences from procedures specified in detail in an existing plan or other references.
- Command and Control - Specifies command relationships specific to the operation, including any changes occurring during transition between phases. Specifies C3 guidance, generally only as it differs from details in an existing plan or other reference.

Crisis Action Planning may terminate with this phase if the crisis situation is resolved or stabilized by other means. If, however, the NCA decides to exercise the military option and order execution of the OPORD, a transition to the next phase occurs.

Execution Phase:
NCA authorization to execute an OPORD is promulgated via an Execute Order message from CJCS. The message format is similar to Warning, Planning, and Alert Orders, but normally only new and modified information is included. The supported CINC issues an Execute Order of his own to the supporting and subordinate commanders, specifying a precise day and hour for execution (or deployment, if not already in progress) to commence. In general (there being few specifics), CJCS and the Joint Staff monitor the ongoing deployment and employment of forces, intervening primarily to resolve conflicts developing between commands or related to other ongoing commitments. The supported CINC executes his own OPORD; he monitors force deployment and modifies movement requirements as needed, and resolves or reports shortfalls. He controls the employment of forces; however, the operational control of forces to accomplish the mission of the OPLAN will normally be exercised by a subordinate Joint Task Force commander, as designated in the Warning Order or other subsequent message. Subordinate and supported commanders execute their OPORDs, continue to furnish forces, and report movement requirements; the Services sustain the forces. USTRANSCOM manages transportation assets, keeps CJCS and the supported CINC advised of deployment progress, and reports any shortfalls to CJCS for resolution. This phase continues until the operation itself is terminated.

2.4. JOINT OPERATION PLANNING AND EXECUTION SYSTEM (JOPES)

JOPES is described as "the integrated Joint conventional command and control system used to support military operation monitoring, planning, and execution activities." It "incorporates policies, procedures, personnel, and facilities by interfacing with automatic data processing (ADP) systems available on the Global Command and Control System (GCCS), reporting systems, and support to senior-level decision makers and their staffs at the NCA level and throughout the Joint Planning and Execution Community (JPEC)." The JPEC is in turn defined as "the headquarters, commands, and agencies involved in training, preparation, movement, reception, employment, support, and sustainment of military forces assigned or committed to a theater of operations"; it includes the Joint Staff, the Unified Commands (CINCs) and their subordinate commands, the Services, and certain defense agencies such as DIA, NSA, DISA, and DLA.

JOPES procedures are described in the CJCSM 3122 manual series. CJCSM 3122.01 provides policies and procedures for both deliberate and crisis action planning, as discussed above. CJCSM 3122.02 describes procedures for building and maintaining TPFDD files. CJCSM 3122.03 and its Secret supplement, CJCSM 3122.04, provide formats and guidance for writing OPLANs and CONPLANs.

The ADP applications on GCCS, which directly support JOPES functions, are primarily legacy systems that migrated from the older WWMCCS environment. They include:

- Requirements Development and Analysis System (RDA), used for force planning involving both individual units and force modules. Among other capabilities, RDA allows a planner to select and modify force modules and units and manipulate movement information.
- Logistics Sustainability and Feasibility Estimator (LOGSAFE), used for support planning. LOGSAFE calculates non-unit movement requirements and produces OPLAN-specific data files based on standard planning factors adjusted for specific theater conditions and expected combat intensity. LOGSAFE replaced the Logistics Capability Estimator, which itself was a replacement for the earlier Movement Requirements Generator.
- Joint Engineering Planning and Execution System (JEPES), which develops requirements for new construction or repair of facilities based on factors including forces to be supported, available host nation assets, and anticipated damage to existing facilities. It supports development of the Civil Engineering Support Plan associated with the OPLAN.
- Medical Planning and Execution System (MEPES), used to generate reports useful in preparing the Medical annex of the OPLAN and in calculating medical-related personnel, facility, supply, and evacuation requirements.
- Individual Manpower Requirements and Availability System (IMRAS) and Force Augmentation Planning and Execution System (FAPES) are both oriented toward support of mobilization planning and execution.
- Joint Feasibility Analysis System for Transportation (JFAST), used to simulate the movement of forces and support requirements from point of origin to port of debarkation, using the strategic lift assets identified as available for the OPLAN. The results of the simulation, when compared to the CINC-specified "Latest Arrival Dates" for the various forces employed in the plan, indicate whether or not the plan is "grossly transportation feasible." Although primarily used with a TPFDD, JFAST also has a built-in capability called the Notional Requirements Generator which, for specified combat forces, will

generate combat support and combat service support requirements and required sustainment in accordance with Service doctrine. The resulting total movement requirements can then be analyzed for transportation feasibility prior to creating a detailed TPFDD -- a useful testing capability for COA analysis and Crisis Action Planning.

The JOPES ADP applications draw upon a number of standard reference files resident in GCCS. In addition, various plan-dependent files, ultimately including the TPFDD, are created by the various JOPES ADP applications.

Standard reference files include:

- GEOFILE - Standard Geographic Locations. List militarily significant locations worldwide and their locations. Used by RDA and LOGSAFE.
- GSORTS - Status of Resources and Training System. Provides real-world U.S. unit readiness data in terms of personnel strength, training readiness, and equipment availability.
- TUCHA - Type Unit Data. Descriptions and movement characteristics (personnel, equipment, and cargo) of notional (generic type) units. File is maintained by the Services. Used by RDA, LOGSAFE, and JEPES.
- TUDET - Type Unit Equipment Detail. Supplementary information on unit equipment and hazardous cargo -- primarily related to large equipment items such as vehicles. Used by RDA.
- FMLIBRARY - Force Module Library. A collection of Service and Joint force modules including combat support, combat service support, and 30 days of sustainment. Used by RDA.
- APORTS - Aerial Ports and Air Operating Bases. Planning factors such as runway capabilities, aircraft parking, fuel storage, and other parameters affecting personnel and cargo throughput.
- PORTS - Port Characteristics. Analogous planning factors related to seaports. Used by RDA.
- ASSETS - Transportation Assets. Information derived from JSCP, concerning the types and time-phased availability of both military and civil airlift and sealift assets. Used by RDA.
- CHSTR - Characteristics of Transportation Resources. Planning factors for airlift (speed, range, cargo capacity by category, load/unload time, utilization rate, etc.) and sealift (speed, capacity, load/unload time, etc.). Used by RDA.
- SDF - Standard Distance File. Airlift and sealift distances between specified Port of Embarkation/Port of Debarkation pairs. Airlift data includes number of stops; sealift data accounts for Suez and Panama Canal availability.
- LFF - Logistics Factors File. Planning factors used to calculate re-supply requirements. Used by LOGSAFE to create files specific to the conditions of an OPLAN.
- CEF - Civil Engineering File. Information on Service construction units and deployable facilities.

In addition to the JOPES-associated ADP applications for planning, various GCCS applications and capabilities are relevant to Crisis Action Planning and actual execution of an Operation Order. These include:

- Common Operational Picture (COP) - Provides a correlated and fused display of air, sea, and land tracks derived from tactical data link inputs, Service display systems, and other systems including the Joint Deployable Intelligence Support System (JDISS). This capability was derived from functionality within the Joint Maritime Command Information System (JMCIS). User capabilities include contact correlation and track database management.
- Global Reconnaissance Information System (GRIS) - Provides access to theater-level reconnaissance schedules, previous sortie reports, and real-time message reports.
- Dynamic Analysis and Re-planning Tool (DART) - Provides the ability to rapidly enter, manipulate, and analyze TPFDD force and movement requirements. DART can graphically represent TPFDD records and display transportation routes and destinations, and offers rapid access to TUCHA and GEOFILE data. Introduced during Desert Shield/Desert Storm, DART can be used in a collaborative, interactive mode by users at different sites.
- Global Transportation Network (GTN) - Integrates transportation information from diverse sources, providing cross-reference between movement requirements and actual airlift and sealift movements, in-transmit visibility to passengers and cargo, and access to specific container and pallet contents. GTN is a Web-based system, operational since 1997, which will also be linked to the commercial data systems of companies that ship DoD cargo.
- Evacuation System (EVAC) - Maintains a database, derived from formatted reports from U.S. embassies and consulates, which provides essential information for creating non-combatant evacuation plans.
- Fuel Resource Accounting System - Assesses the supportability of plans (including simultaneous execution of multiple plans) in terms of the time-phased availability of bulk petroleum. Uses the Logistics Factors File.
- Global Status of Resources and Training (GSORTS) - Allows tailored display of unit status information from the GSORTS file, including location display within digital maps.
- Air Tasking Order (ATO) - Via interface with the Contingency Theater Automated Planning System (CTAPS), allows tailored access to specific parts of an Air Tasking Order for printing or display.
- Theater Analysis and Re-planning Graphical Execution (TARGET) - Provides a "set of planning tools designed to support the operational planner during crisis action procedures." TARGET supports distributed, collaborative COA development and analysis, plan generation, scheduling, and analysis among Joint Staff, supported and supporting CINCs, component commands, and the designated Joint Task Force. TARGET offers "rapid access to required documents, information sources, analysis tools, multimedia, and teleconferencing tools." Included in TARGET is a Course of Action Selection Tool (COAST), which appears to provide a capability to generate a COA decision matrix as discussed in Section 5.1 below. COAST was originally developed by Cubic Applications, Inc. for the Army Battle Command Laboratory.
- GCCS utility software, including message handling, email, teleconferencing, telnet, and file transfer.

2.5. JOINT TASK FORCE PLANNING

Designation of a Joint task force (JTF) is one of the command organization options for executing a short-notice contingency operation.

A Joint task force is defined as "a force composed of assigned or attached elements of the Army, the Navy or the Marine Corps, and the Air Force or two or more of these Services, that is constituted and so designated by the Secretary of Defense, by a CINC, or by the commander of a subordinate unified command or an existing Joint task force." (A force composed only of Navy and Marine Corps elements is not a JTF.)

A JTF is normally established "when the mission has a specific limited objective..." but requires "execution of responsibilities involving two or more Services on a significant scale and close integration of effort..."

The authority establishing a JTF designates the commander and assigns the mission and forces. The JTF is dissolved when it has fulfilled its stated purpose.

The JTF commander exercises operational control (OPCON) over his assigned and attached forces. He is responsible for "making recommendations to the superior commander on the proper employment of assigned forces and for accomplishing such operational missions as may be assigned by the establishing commander."

Additional specific responsibilities include the following:

For the establishing authority:

- Designate the geographic area of responsibility for the JTF and the date and time it is to be activated.
- Develop, and obtain approval for, appropriate rules of engagement.
- Monitor the operational situation and keep superiors informed.
- Determine if supporting forces are required, and if so prepare a directive defining the support relationship.
- Allocate or request additional forces or other national assets as required.
- Ensure necessary administrative and logistics support is provided to the Commander, Joint Task Force (CJTF.)
- Establish, or assist in establishing, liaison with concerned U.S. embassies and foreign governments.
- Provide guidance to the CJTF with respect to plans, administration, logistics, organization, etc.
- Advise CJTF of changes in plans, and modify mission and forces as needed.
- Approve CJTF plans.

For the CJTF:

- Develop a detailed plan under Crisis Action Planning guidelines, using applicable OPLANs or CONPLANs, if any, to "maximize the benefits of deliberate planning."

- Apportion tasks needed to accomplish the plan to subordinate commanders.
- Organize and use assigned forces to best perform the mission.
- Provide guidance to subordinate forces for the planning and conduct of operations.
- Request supplemental rules of engagement as required to accomplish the mission.
- Monitor the operational situation and keep the superior commander informed.
- Coordinate with other forces and agencies as required, including friendly foreign forces and governments.

For the CJTF's component commanders:

- Plan and conduct operations in accordance with CJTF guidance and detailed plans.
- Monitor the operational situation and provide information to CJTF as required.
- Provide liaison personnel to CJTF, other component commanders, and supporting commanders as directed or required.
- Coordinate with other JTF components, with supporting forces and agencies and with friendly foreign forces and governments as directed/authorized and necessary.

The CJTF "has full authority to organize all elements of assigned and attached forces as necessary to accomplish assigned missions." A JTF is normally organized into Service component commands, but other types of component commands may also be used, including subordinate JTFs, functional component commands organized for a specific purpose (such as special operations), or single-service forces reporting directly to the CJTF rather than to a Service component commander.

A JTF begins to participate in Crisis Action Planning as soon as it is established, normally in connection with a CJCS Warning Order or Planning Order. Such a JTF may be specified under a contingency not covered by an existing OPLAN or CONPLAN, in which case the CINC in whose Area of Responsibility the contingency has occurred is responsible for the deployment planning (TPFDD development) aspects of CAP. If, however, the JTF is "pre-planned," with its existence and composition specified in an OPLAN or CONPLAN, that JTF, when established, undertakes deployment planning as well. During the execution planning phase of CAP, while the supported CINC's staff creates its Operation Order, the JTF staff normally prepares a more detailed OPORD of its own.

In many cases, the JTF headquarters itself must be forward deployed, either ashore or afloat. In the former case, the deployment from home to forward location is normally incremental. Command and control of the JTF initially resides at the pre-deployment headquarters of CJTF. The first deploying element may be a "liaison" increment, with no command and control capability; this may be followed by a JTF HQ Advanced Echelon (ADVON), with a minimum C2 capability to support the initial buildup of forces.

Appendix A of Joint Pub 5.00-2, Joint Task Force Planning Guidance and Procedures, provides a checklist for the CJTF and his staff, phrased as questions and arranged by the phases of Crisis Action Planning. The publication notes that, depending on the composition and location of the JTF, completing many of the checklist items may be beyond the capabilities of the JTF staff, in which case the assistance of the superior commander (generally a Unified Command CINC) should be sought. Items associated with the Situation Development phases are addressed at higher levels if the JTF has not yet been established. The questions below are excerpted from the Joint Pub 5.00-2 checklist to provide an indication of the breadth of planning activities required for Joint operations.

(CAP Phase I - Situation Development)

(1) What are the national and military strategies and US national security policy for the region or country?
(2) What is the nature of the conflict or crisis that might require military resources to resolve it?
(3) What are or might be the potential missions or tasks from the NCA?
(4) Will action be unilateral or Combined?
(5) What is the current situation (who, what, when, where, and why)?
(6) How will the adversary conceptualize his situation and ours? What are his goals, objectives, strategy, intentions, capabilities, methods of operation, vulnerabilities, and sense of value and loss?
(7) What steps can be taken to collect additional information?
(8) What is the status of communications with key US and foreign government agencies and personnel? Has a list of key phone numbers been established?
(9) Has the CINC developed an intelligence collection plan?
(10) Has the CINC deployed sufficient organic reconnaissance resources? Should national assets be tasked or repositioned?
(11) Are any US or allied forces conducting operations within the JTF AOR? What type? Duration? Who commands those forces?
(12) What is the status of communications to and within the AOR?

(CAP Phase II - Crisis Assessment)

(13) Is noncombatant evacuation needed? Are there any US or other DoD civilian noncombatants in the AOR? How many? Where are they located? Are they in any danger? Is there a noncombatant evacuation plan for this AOR? Has the Department of State (DoS) authorized NEO? Has DoS asked for DoD assistance?
(14) Have agencies or commands (e.g., Defense Mapping Agency (DMA), environmental support facilities) that provide specialized or long-lead support been notified of the ongoing analysis and the potential for future support? What dedicated communications should be established with these agencies or commands for use by operations, intelligence, and logistics personnel?
(15) What requests, if any, have been made by the foreign government(s)? What is the DoS position?
(16) What security assistance may be provided to the foreign government(s) concerned?
(17) What humanitarian or civil assistance may be provided to the foreign government(s)?
(18) What sources have been identified to fund assistance efforts?
(19) Does the United States have any treaty or legal obligations?
(20) Are there status-of-forces agreements with the foreign government(s)?
(21) Is a military coordinating committee required?
(22) Is there an OPLAN or CONPLAN for the area or situation?
(23) What type and level of psychological operation (PSYOP) is most advantageous for the current situation?
(24) What are the key friendly, enemy, and neutral target groups and their PSYOP vulnerabilities?
(25) Is a database maintained by USTRANSCOM that is current or applicable to the situation?
(26) Are there adequate provisions to maintain secrecy, achieve surprise, and preserve the security of US forces against attack?
(27) What operations security (OPSEC) and operational deception measures are required? Is a cover story required or available? Are diversionary actions needed to support the preparation, deployment, and employment of forces?
(28) What national-level actions are necessary to protect secrecy and execute deceptions?

(29) What are foreign governments' (including hostile) appreciations of US intentions and military capabilities? How could these be shaped to US advantage?
(30) What are the reactions of friendly, neutral, and unfriendly foreign governments?
(31) What level of opposition can be expected from hostile governments?
(32) What support can be expected from friendly and allied governments?
(33) What access and overflight assurances do friendly forces have for deployment or employment operations?

(CAP Phase III -- Course of Action Development)

(34) What precisely must be accomplished in the crisis to strengthen or support the objectives established by the NCA?
(35) What are the general operations, intelligence, and logistic requirements to support the actions so as to bring about the NCA objectives?
(36) Do the military objectives identified take into account exploitable enemy vulnerabilities that are critical to the CJTF's responsibilities and intent or are critical to the enemy's intent?
(37) From the CJTF's perspective, are the military objectives obtainable?
(38) What is the commitment of the adversary to his COA?
(39) What are the current ROE in the area? Do they need to be changed because of the current situation? Who should recommend changes?
(40) Is the authorization to use riot control agents required as an alternative to the use of deadly force to save lives? Has NCA approval been requested or received? Are agents and protective equipment available to friendly forces?
(41) What forces are readily available and when could they arrive on scene?
(42) What reception and operations support facilities are needed and available?
(43) What types and amounts of logistic support are available from friendly and allied nations?
(44) Are Joint or allied interoperability considerations involved?
(45) Is medical support adequate to support planned operations?
(46) What medical support is available in the objective area or provided for in the OPLAN?
(47) Are special operations forces required (e.g., USSOCOM, theater SOC, or host-nation SOF)?
(48) What is the unit readiness of the available or allocated forces?
(49) What are the major constraints before forces can be committed?
(50) What is the status of mapping, charting, and geodesy support within the area?
(51) What are the environmental (meteorological, oceanographic) support capabilities and constraints within the area? Who is coordinating environmental support?
(52) Will special CJCS-controlled communications assets, such as JCSE, be required?
(53) Are Army or Air Force PSYOP units, or Navy supporting units, required?
(54) What is the command relationship of civil affairs (CA) and PSYOP forces?
(55) Will the use of deception operations enhance mission success for each COA being considered?
(56) Have subordinate and supporting commands or agencies been tasked to enter JOPES data base requirements for development of deployment estimates by USTRANSCOM?
(57) Has Tactical Exploitation of National Capabilities Program (TENCAP) support from the supported commander been requested?
(58) Have plans for the use of space systems (e.g., for reconnaissance, surveillance, warning, navigation, communications, targeting, weather) been integrated into JTF plans?
(59) What is the status of strategic mobility resources and supporting elements? Are facilities, airports and seaports, and lines of communication (LOCs) capable of supporting the operation?
(60) What are the logistic factors that affect actions under consideration?

(61) Is aerial refueling required during employment and/or deployment?
(62) Will an intermediate staging base be required?
(63) Has direct coordination been authorized or established, as applicable, within the operational, intelligence, and logistic nets, with the committed forces, supported and supporting commands (as applicable), and national agencies?
(64) What is the backup COA?
(65) What all-source intelligence resources are available? Has the full range of intelligence capabilities been employed to ensure maximum intelligence support to planning efforts by the CINC? By the NCA? Has CJTF declared emergency reconnaissance and implemented SIGINT operational tasking authority (SOTA)?
(66) Has coordination been conducted with USSPACECOM to determine whether repositioning or launch of space systems is required for JTF operations?
(67) Will electronic warfare units, such as WILD WEASEL, radar jammers, or communications jammers, be required?
(68) Which airfields are available to friendly forces? Will use agreements need to be coordinated with other nations? Are runway lengths and weight-bearing capacities adequate for the planned forces?
(69) What COMSEC procedures must be established to protect communications between the United States and foreign forces and governments?

(CAP Phase IV -- Course of Action Selection)

(70) What COA has been selected? Have the pros and cons of each alternative, with regard to enemy options, been fully and objectively assessed?
(71) What decisions have yet to be made? What changes to ROE are required?

(CAP Phase V -- Execution Planning)

(72) Is the mission clear? Is CJTF's intent clear?
(73) Are the ROE adequate for the JTF mission?
(74) Will the selected military COA accomplish the objectives? If it will not, has this been clearly outlined to the superior commander? Is the COA consistent with the law of armed conflict?
(75) Are command relationships clear, unambiguous, and understood by all parties?
   a. Between supporting and supported commanders?
   b. For command and control for SOF?
   c. For command and control of CA and PSYOP forces?
(76) Before operations commence, have the theater and JTF J-2s and J-3s established a Joint Intelligence Center (JIC)?
(77) Has a Joint Rescue Coordination Center (JRCC) been designated or established?
(78) Has CJTF elected to designate a Joint Forces Air Component Commander (JFACC) to coordinate Joint air operations? If so:
   a. Have the authority and responsibilities of the JFACC been established by CJTF?
   b. Are commanders of the JTF components aware of JFACC's assigned authority and responsibilities?
   c. Have liaison officers from JTF components been assigned to the JFACC to facilitate coordinated Joint force air operations?
(79) Has CJTF elected to designate any other functional component commanders (e.g., JFLCC, JFMCC, JFSOCC)? If so, questions a, b, and c of item above apply to each.

(80) Has airspace coordination been addressed? (May be assigned as a JFACC responsibility, if designated.) Is required liaison provided?
(81) Has an AADC been assigned? (May be assigned as a JFACC responsibility, if designated.) Is required liaison provided?
(82) What is the status of communications?
  a. Have multiple means of communications been provided for?
  b. Is there frequency deconfliction?
  c. Are the Joint communications-electronics operation instructions (JCEOI) adequate?
  d. Is there a requirement for Joint airborne communications assets?
  e. Have common COMSEC materials (authenticators, operations codes, keylists, etc.) been identified for all circuits, networks, and users?
  f. Are there any other special C3 requirements?
(83) What country clearances are required for overflight, landing, or staging? What are the existing (or needed) agreements for overflight; staging; transit and refueling for combat, cargo, and evacuation aircraft; and basing rights?
(84) What forces and concept of operations are available if the adversary escalates abruptly?
(85) Has sufficient coordination with allies been conducted?
(86) What constraints have been placed on USTRANSCOM's components (e.g., allocation of lift assets)?
(87) What is the status of space system support coordination?
  a. If a tactical missile threat exists, has a special request for tactical warning support been made to USSPACECOM's J3CP? Additionally, has USSPACECOM been requested to provide support from the Tactical Event Reporting System (TERS), to include equipment required to receive TERS downlink data?
  b. Has military satellite communications (MILSATCOM) support been coordinated with the DISA MILSATCOM Systems Office?
  c. Has Defense Satellite Communications System (DSCS) Ground Mobile Facility (GMF) support been coordinated with the appropriate Regional Space Support Center (RSSC)?
  d. Has USSPACECOM been requested to provide liaison officer support to the JTF to serve as a focal point for the coordination of space systems support?
(88) Has the enemy situation changed appreciably; if so, what are the effects on the selected COAs?
(89) Have all necessary actions been taken to provide for self-defense of JTF forces?
(90) Will the predicted environmental conditions adversely affect the operation? Who will provide environmental updates to decision-makers?
(91) Is logistic and administrative planning adequate?
(92) Has the OPORD been published?
(93) Do the component commanders' plans adequately address the coordinated employment, direction, and control of their forces in conformity with the JTF concept of operation?
(94) What is the status of the JOPES data base sourcing and error correction?

(CAP Phase VI -- Execution)

(95) Has intelligence identified front line enemy movements or changes in the disposition of rear echelon, strategic, or other critical units, particularly Special Forces?
(96) Are any changes necessary to ensure that military action will accomplish the objectives intended?

2.6. REFERENCES

1. Armed Forces Staff College, AFSC Pub 1, The Joint Staff Officer's Guide 1997; available online at http://www.afsc.edu/pub1/afsc0000.htm
2. Joint Chiefs of Staff, Joint Pub 5-00.2, Joint Task Force Planning Guidance and Procedures, September 1991; available as .pdf file at http://www.dtic.mil/doctrine/jel/c_pubs3.htm

3. ARMY PLANNING PROCEDURES

The following discussion is derived from FM 101-5, Staff Organization and Operations, which describes basic doctrine covering staff roles, relationships, organization, and responsibilities within Army units at corps level and below. It is "the Army's doctrinal source for the military decision making process, the doctrinal approach to decision making that helps the commander and his staff examine a situation and reach logical decisions."

Role of a Staff:
The role of a staff in supporting its commander is summarized in FM 101-5 as follows:

> *"The commander and his staff focus on recognizing and anticipating battlefield activities in order to decide and act faster than the enemy. All staff organizations and procedures exist to make the organization, analysis, and presentation of vast amounts of information manageable for the commander. The commander relies on his staff to get from battlefield "information" to battlefield "understanding," or situational awareness, quicker than his adversary. Once a decision is made, the commander depends on his staff to communicate the decision to subordinates in a manner that quickly focuses the necessary capabilities within the command to achieve the commander's vision or will over the enemy at the right place and time.*
>
> *"The primary product the staff produces for the commander, and for subordinate commanders, is understanding, or situational awareness. True understanding should be the basis for information provided to commanders to make decisions. Formal staff processes provide two types of information associated with understanding and decision making. All other staff activities are secondary. The first is situational awareness information, which creates an understanding of the situation as the basis for making a decision. Simply, it is an understanding of oneself, the enemy, and the terrain or environment. The second type of information, execution information, communicates a clearly understood vision of the operation and desired outcome after a decision is made. Examples of execution information are conclusions, recommendations, guidance, intent, concept statements, and orders."*

Role of Command and Control Systems:
FM 101-5 addresses command and control systems briefly and does so in the context of the broad JCS definition which comprises facilities, equipment, communications, personnel, and procedures. The C2 system is described as "an organization of resources the commander uses to help plan, direct, coordinate, and control military operations to ensure mission accomplishment":

> *"Neither the commander nor his staff should consider the C2 system an end unto itself. It only exists to support the commander and help him make the decisions necessary for accomplishing his mission. For example, while exercising command, a commander issues orders that serve as input to subordinate units. As each subordinate unit plans and executes its mission, it produces feedback to its higher commander and his staff. These are the essential measures that support effective C2. Command and control is continuous, and its activities are interrelated."*

Battlefield Visualization:
The commander's understanding, vision, and intent with regard to a mission, is embodied in the concept of "battlefield visualization":

> *"Battlefield visualization is the process whereby the commander develops a clear understanding of his current state with relation to the enemy and environment, envisions a desired end state, and then visualizes the sequence of activities that will move his force from its current state to the end state. In short, it provides the key to where and how the commander can best lead and motivate soldiers, and see the battlefield, his own forces, the enemy, and the end state.*
>
> *"It is critical to mission accomplishment that commanders have the ability to visualize the battlefield. Therefore, in his intent statement, the commander must clearly articulate his battlefield visualization to his subordinates and staff to ensure the optimum development and execution of his concept of operations.*
>
> *"The staff assists the commander with his battlefield visualization by collecting, processing, analyzing, and transforming data into knowledge, allowing the commander to apply his judgment to achieve understanding of the situation in the form of his vision. The staff then helps him communicate his battlefield visualization to his subordinates by preparing orders and informational products to achieve a relevant common picture and situational awareness. An information network must be in place and operating to support battlefield visualization."*

3.1. THE MILITARY DECISION-MAKING PROCESS

The full military decision-making process (MDMP) is described as

> *...A detailed, deliberate, sequential, and time-consuming process used when adequate planning time and sufficient staff support are available to thoroughly examine numerous friendly and enemy courses of action (COAs). This typically occurs when developing the commander's estimate and operation plans (OPLANs), when planning for an entirely new mission, during extended operations, and during staff training designed specifically to teach the MDMP. The MDMP is the foundation on which planning in a time-constrained environment is based. The products created during the full MDMP can and should be used during subsequent planning sessions when time may not be available for a thorough relook, but where existing METT-T (mission, enemy, troops, terrain, and time available) factors have not changed substantially.*

The full MDMP consists of seven steps—receipt of mission, mission analysis, COA development, COA analysis, COA comparison, COA approval, and orders production. Completion of these steps is followed by a rehearsal; at any point during subsequent mission execution and assessment, circumstances may dictate that the process begin anew.

Step 1: Receipt of Mission
A new mission may be associated either with an order from a higher headquarters or with the commander's own determination, during an ongoing operation, that circumstances dictate a new course of action. The immediate staff response is to gather needed "tools" -- the higher headquarters'

order or plan and relevant Field Manuals, Standard Operating Procedures, maps, and existing staff estimates. An assessment must be made as to the amount of time available for planning and, if necessary, the extent and method by which the MDMP must be abbreviated; this and other initial information (such as authorized movements or reconnaissance) is expressed in a brief commander's initial guidance. This step culminates in issuance of a warning order to subordinate and supporting units; this enables "parallel planning" to commence at lower echelons based on initial information. It is a general rule that the commander allocates one third of the total time available to his own staff to complete planning; the remaining time is then available to subordinate headquarters for their own (and their subordinates') planning and preparation.

Step 2: Mission Analysis

Mission analysis consists of seventeen steps, not all necessarily sequential, which define the tactical problem and facilitate the process of determining feasible solutions. The steps are:

- Analyze the higher headquarters' order. Ensure that the higher commander's intent, mission, and concept of operations, as well as the missions of adjacent units, are understood throughout the staff. The mission statement and commander's intent from two echelons above should also be available to the staff.
- Conduct initial intelligence preparation of the battlefield. This is a dynamic process which examines the character of the battlefield environment and intelligence regarding the enemy, and results in determination of the possible enemy COAs and their probable order of adoption.
- Determine specified, implied, and essential tasks. Specified tasks are those specifically assigned by higher headquarters; from these, the staff derives implied tasks which must be accomplished in order to meet the specified tasking. As approved by the commander, these become "essential tasks."
- Review available assets. Determine if available resources are sufficient to accomplish essential tasks; identify any additional resources required.
- Determine constraints. Determine those requirements or prohibitions imposed by higher authority which restrict the commander's freedom of action.
- Identify critical facts and assumptions. Assumptions include those received from higher headquarters. Additional assumptions take the place of missing critical information; they should be valid (likely to be true) as well as necessary to the conduct of planning.
- Conduct risk assessment. The commander determines where he might take tactical risk (associated with the enemy's presence and capabilities); the staff determines areas of accidental risk (related to the environment, training and capabilities of units, and other factors not associated with the enemy). This is the beginning of a risk management process, including developing and implementing controls, which continues through the MDMP.
- Determine initial commander's critical information requirements (CCIR). A short list is developed comprising priority intelligence requirements, friendly force information requirements, and essential elements of friendly information (information which should be protected from enemy information-gathering capabilities).
- Determine the initial reconnaissance annex. Reconnaissance and surveillance must be conducted as needed to support mission planning.
- Plan use of available time. Schedule required briefings and rehearsals.
- Write the restated mission. The mission is restated based on the above analysis, specifying the essential who, what (attack, defend, etc.), when, where, how, and why.
- Conduct a mission analysis briefing. The commander is briefed on the results of the staff's analysis as described in the previous steps.

- Approve the restated mission. The commander approves (or modifies) the statement of the command's mission.
- Develop the initial commander's intent. The commander's intent is developed and delivered personally by the commander, face-to-face where possible. It is "a clear, concise statement of what the force must do to succeed with respect to the enemy and the terrain and to the desired end-state. It states "the key tasks that, along with the mission, are the basis for subordinates to exercise initiative when unanticipated opportunities arise or when the original concept of operations no longer applies." In written form, it is normally no more than four or five sentences.
- Issue the commander's guidance. The commander, either orally or in writing, provides guidance to the staff concerning his concepts for accomplishing the mission; these usually serve to guide the staff's selection of COAs for development and analysis.
- Issue a warning order. Subordinate commanders are provided with the restated mission, commander's intent, and other relevant products of mission analysis.
- Review facts and assumptions. This is a continuing activity throughout the MDMP and may result in adjustments at any point in the process.

Step 3: Course of Action Development

Based on the commander's guidance and intent, the staff develops courses of action meeting the requirements of suitability, feasibility, acceptability, distinguishability, and completeness. Other desired characteristics are unpredictability (from the enemy's viewpoint) and the flexibility to accommodate unforeseen events and provide maximum latitude for initiative by subordinates. A good COA should be capable of countering any feasible enemy COA.

The normal steps in COA development are as follows:

- Analyze relative combat power. Combat power is defined as "the effect created by combining the elements of maneuver, firepower, protection, and leadership in combat against the enemy." This step includes an estimate of friendly versus enemy force ratios, using units two levels down if applicable. This should be largely subjective, considering human and other intangible factors as well as force strength and hardware capabilities. Planning data is available (in FM 34-130) to suggest which types of operations may be successful given the estimated force ratios.
- Generate options. A "brainstorming" approach is recommended, allowing for the exercise of imagination within the limits of the commander's guidance and the requirements of doctrine with respect to specific types of operations. Main and supporting efforts, and their associated essential tasks, are defined for each option.

For each option:

- Array initial forces. This step is performed using the force ratios estimated to be required for each task. Terrain and deception considerations are applied in determining where to place forces, which at this point are generic units; specific units, or unit types, are not identified.
- Develop the scheme of maneuver. A description of how the arrayed forces will develop the commander's intent is developed; at this point, specific unit types (armor, mechanized infantry, etc.) are specified.
- Assign headquarters. An appropriate task organization is created by associating headquarters to groupings of forces.

- Prepare COA statement and sketch. The mission, scheme of maneuver, and end state should be specified, together with significant risks. The tasking of subordinate units should be clear.
- Provide a COA briefing. This is an optional step, enabling the commander to accept or reject various COAs prior to the conduct of war gaming.

Step 4: Course of Action Analysis
This step employs war gaming, described as:

> *" . . . a disciplined process, with rules and steps, that attempts to visualize the flow of a battle. The process considers friendly dispositions, strengths, and weaknesses; enemy assets and probable COAs; and characteristics of the area of operations. It relies heavily on a doctrinal foundation, tactical judgment, and experience. It is an iterative process of action, reaction, and counteraction."*

An accurate record is kept of the advantages and disadvantages of each COA. Any COA that fails the tests of feasibility, acceptability, and suitability at any point during the war game must be rejected.

The steps of the war gaming process are defined as:

- Gather the tools. War gaming may occur on maps, sand tables, or "other tools that accurately reflect the nature of the terrain."
- List all friendly forces. The same list of available combat, combat support, and combat service support forces is employed for each COA.
- List assumptions.
- List known critical events and decision points. Critical events include the identified essential tasks, complicated tactical actions required detailed consideration, and events which may trigger significant enemy actions. Decision points are locations or events where tactical decisions will be required. Separate lists are required for each COA. The number of critical events and decision points impacts the length of the war game; the lists must be kept short where time is critical.
- Determine evaluation criteria. These are the factors which will be used to measure one COA against another, and may be whatever the commander chooses; they may include the "principles of war" (objective, offensive, mass, economy of force, maneuver, unity of command, surprise, and simplicity), risk, and/or functional areas (fires, intelligence, C2, etc.).
- Select the war game method. Recommended methods, which can be used in combination, include:

  1. The belt technique - The battlefield is divided into belts running across the width of the area of operations. A sequential analysis is conducted of events in each belt. This technique is appropriate for phased operations or against an enemy arrayed in echelons.
  2. The avenue-in-depth technique - Each avenue of approach is considered separately, beginning with the main effort. This technique supports offensive operations and circumstances where "canalizing terrain" limits mutual support.
  3. The box technique - A detailed analysis of a critical geographic area, associated with an essential task, is conducted. This may be the most appropriate technique where time is short.

- Select a method to record and display results. Accurate recording of game results not only supports COA comparison but also facilitates developing plans or orders for the approved COA. Two suggested methods are:

  1. Synchronization matrix - A time line is displayed at the top. Below that are separate lines showing likely enemy actions and friendly decision points. Additional lines show actions associated with separate functional areas or subordinate units.
  2. Sketch note method - Critical events, cross-referenced to locations on a map, are annotated on a work sheet; information includes tasks assigned, allocated forces, expected enemy actions/reactions, friendly counteractions, decision points, time required, and critical information requirements.

- War game the battle and assess the results. The war game is conducted by examining each critical event in terms of a cycle of actions (by the offensive side), reactions by the opposing side, and counteractions in response to those reactions. This cycle continues until the event is completed (or the COA is determined to be inadequate). The COA being examined may actually be modified during the war game; in all cases, the process should result in considerable refinement of the COA, including "identifying branches and sequels that become on-order or be-prepared missions."

Step 5: Course of Action Comparison

The objective of this step is to select the COA with the highest probability of success when compared to both the most likely and most dangerous enemy COAs. It should also: pose the minimum risk to troops, equipment, and mission accomplishment; best position the force for future operations; and provide flexibility to address unforeseen circumstances and allow initiative by subordinates. All staff sections participate in the process, each viewing from its specialized perspective. The results of the analysis are normally expressed in a decision matrix, listing the selected evaluation criteria and (in most cases, as assigned by the CoS/XO), the weight value assigned to each. A value (weight times "score") is assigned to each criterion for each war gamed COA. The matrix thus readily indicates which COA appears "best" for each criterion; moreover, a total score can be determined for each COA by adding its weighted values across all criteria, although the value of this is considered questionable.

Step 6: Commander's Decision Briefing

This briefing provides the commander with the staff's recommended COA. COAs considered, including the assumptions used and the advantages and disadvantages of each, are reviewed, as are the higher commander's intent, the restated mission, and the status of own and enemy forces.

Step 7: Course of Action Approval

The commander determines the COA to be adopted; if he modifies a presented COA, or selects an altogether new one, the war gaming process must be repeated in order to refine that COA. Once the commander's choice is made, a warning order is provided to subordinate units to facilitate their planning.

Step 8: Orders Production

The staff must transform the selected COA into an operation plan or order. The COA statement provides the basis for the concept of operations statement in the plan/order. FM 101-5 provides extensive guidance as to format and content.

Adapting the MDMP to a Time Constrained Environment:
Where time is short, the MDMP can most effectively be compressed by:

- Increasing the commander's personal involvement during the process, rather than having him wait for formal briefings.
- Having the commander being more specific in his guidance, limiting the options to be explored by the staff.
- Limiting the number of COAs to be developed and war gamed; in the worst case, it may be necessary to develop a single acceptable, refined COA, not necessarily "best" but capable of accomplishing the mission.
- Maximizing opportunities for parallel planning by keeping subordinate commanders informed, through both warning orders and informal means.

3.2. REHEARSALS

Rehearsals are discussed in Annex G of FM 101-5. They provide for the practicing of key combat actions, allowing participants to become familiar with the operation, the environment, and their roles in relation to those of other units. Rehearsals "allow subordinate units and leaders to analyze the tactical plan to ascertain its feasibility, its common sense, and the adequacy of C2 measures before it is too late."

Various types of rehearsals are defined, some of which are little more than formalized conversations between commanders. The most significant type, from the MDMP standpoint, is the combined arms rehearsal, which is conducted by a maneuver unit headquarters after its subordinate units have completed their own OPORDs. It ensures that the subordinates' plans are mutually synchronized and that they will achieve the intent of the higher commander.

Six types of rehearsal techniques are identified; the decision as to which to use is influenced by the time available as well as considerations such as operational security. Beginning with the most complex and time consuming, they are:

1. Full dress rehearsal . This involves all participating personnel, using terrain and time of day best replicating the actual operation.
2. Reduced force rehearsal. This is similar to the previous type, with the exception that only key leadership personnel are involved.
3. Terrain model rehearsal. Instead of having leaders walk through real terrain, a model is built, preferably overlooking the actual terrain. Icons are placed on the model to indicate units and are moved as the rehearsal progresses.
4. Sketch map rehearsal. A sketch is used instead of a terrain model, with movable symbols to denote units.
5. Map rehearsal. No specialized rehearsal tools are used; instead, leaders view the same map and overlays used to plan the operation.
6. Radio rehearsal. Instead of gathering together, participants remain in their headquarters and converse by radio; each must have access to the OPORD and overlays.

The rehearsal is normally directed by the unit CoS/XO, with the commander as an active participant. The G2/S2 portrays the enemy, using his best assessment of the enemy COA. A recorder is designated to capture any directed changes or clarifications by the commander, which should be reviewed at the end of the rehearsal and published as a fragmentary order.

The rehearsal is essentially a verbal walk-through of the concept of operations. A similar action-reaction-counteraction sequence is used in war gaming; unit commanders indicate at each point the actions they are taking and the desired effects. If, following an enemy move, a unit has reached a decision point, the commander indicates his decision to either remain on the current course or select a branch. Once the desired end state is reached, the rehearsal "re-cocks" to that decision point; the commander states the conditions under which he would select an alternate branch, those conditions are assumed true, and the rehearsal then proceeds along that different branch to the desired end state. The rehearsal should ultimately play through all decision points and all branches.

3.3. REFERENCES

1. Headquarters, Department of the Army, FM 101-5, Staff Organization and Operations, 31 May 1997; available online at http://www.cogtech.com/MEMO/Army_Documents/FM-101-5/F540-TOC.HTM

4. JOINT VISION 2010

Joint Vision 2010 (JV 2010) is described as "an operationally based template for the evolution of the Armed Forces for a challenging and uncertain future" which must "become a benchmark for Service and Unified Command visions."

Future Environment:
The document foresees a future geopolitical, military, and technological environment that includes the following characteristics:

- A smaller U.S. military force than in previous decades, with a smaller percentage forward-based overseas, and with a public expectation of greater efficiency and less disruption (such as environmental damage during training, or collateral damage or excess casualties during operations). This implies a need for a "seamless integration" of Service capabilities; "future commanders must be able to visualize and create the 'best fit' of available forces needed to produce the immediate effects and achieve the desired results."
- The expectation that nearly all future operations will be multinational, involving allied and coalition forces.
- The likelihood that access to advanced technology and modern weapons will provide more nations with "sufficient military potential to upset regional balances of power."
- Specific advances in technology involving:
    - Long-range precision capability, combined with a wide range of delivery systems capable of a broad range of weapons effects, which will permit "enhanced economy of force and a higher tempo of operations."
    - Advances in low observable technologies and the ability to mask friendly forces, providing improved survivability and an enhanced ability to engage the adversary.
    - Concurrent improvements in detection technology, including multi-spectral capabilities and automatic target recognition.
    - Improvements in the capability and availability of information technology:

> *"Information technology will improve the ability to see, prioritize, assign, and assess information. The fusion of all-source intelligence with the fluid integration of sensors, platforms, command organizations, and logistic support centers will allow a greater number of operational tasks to be accomplished faster. Advances in computer processing, precise global positioning, and telecommunications will provide the capability to determine accurate locations of friendly and enemy forces, as well as collect, process, and distribute relevant data to thousands of locations. Forces harnessing the capabilities potentially available from this system of systems will gain dominant battlespace awareness, an interactive 'picture' which will yield much more accurate assessments of friendly and enemy operations within the area of interest. Although this will not eliminate the fog of war, dominant battlespace awareness will improve situation awareness, decrease response time, and make the battlespace considerably more transparent to those who achieve it."*

Implications:

The implications of technological change for the U.S. military include:

- An "order of magnitude improvement in lethality." It will be possible to attack targets using fewer platforms and less ordnance. Small units will possess greater capabilities; power projection can be accomplished more quickly, with a reduced logistic tail. The fact that an adversary may also have access to similar capabilities may render the battlespace more lethal to our own forces as well, who will thus require superior mobility, increased dispersion, and passive protection means (such as stealth capability).
- A need for improved communications and coordination capabilities for the synchronization of these more mobile and dispersed forces:

> *"The implications of improved systems integration are both profound and complex. New technologies will allow increased capability at lower echelons to control more lethal forces over larger areas, thus leveraging the skills and initiative of individuals and small units. These capabilities could empower a degree of independent maneuver, planning, and coordination at lower echelons, which were normally exercised by more senior commanders in the past. Concurrently, commanders at higher echelons will use these technologies to reduce the friction of war and to apply precise centralized control when and where appropriate.*
> *"Even for higher level commanders, the accelerated operational tempo and greater integration requirements will likely create a more stressful, faster moving decision environment. Real-time information will likely drive parallel, not sequential, planning and real-time, not prearranged, decision-making. The optimal balance between centralized and decentralized command and control will have to be carefully developed as systems are brought into the inventories."*

- A need (dictated by the increased availability and application of new information technologies) for increased attention to both offensive and defensive information warfare in order to obtain information superiority. Information superiority is "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same".
- An opportunity and need to redefine the concept of "mass" at the operational level. Previous practice has been characterized by physically massing forces over time and space, and conducting sequential operations. However, it will be possible in the future to achieve equivalent "mass" through the "tailored application of combat power," using precision targeting, longer-ranged systems, and improved command and control based on "fused, all-source real-time intelligence."

Conceptual Framework:

Joint Vision 2010 sets forth a "new conceptual framework for operations" which is to support the process of developing "the full range of required enhancements" to best exploit new technologies. The basis of the framework is information superiority, permitting full exploitation of improved command, control, and intelligence capabilities. These capabilities, together with other applications of new technology, will "transform the traditional functions of maneuver, strike, protection, and logistics," making them in effect, new mutually reinforcing operational concepts as follows:

- Dominant Maneuver - the capability to "position and employ widely dispersed Joint air, land, sea, and space forces to accomplish the desired operational tasks."

- Precision Engagement - the employment of a "systems of systems" to locate targets, provide responsive command and control, generate the desired effects, assess the results, and reengage if required.
- Full-Dimensional Protection - the capability to control the battlespace through multi-layered defenses for forces and facilities at all levels, providing freedom of action during deployment, maneuver, and engagement. This capability will counter an adversary's attempts to use counterparts of the same technologies being exploited by our own forces.
- Focused Logistics - a "responsive, flexible, and precise" capability to provide rapid crisis response and "deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical levels of operations."

"Full Spectrum Dominance":
Although oriented primarily toward "high intensity conventional military operations," the JV 2010 conceptual framework supports the achievement of "Full Spectrum Dominance" across the full range of operations by providing rapid response, reduced vulnerability for our own forces, and the ability to readily recognize and counter emerging threats. The operations include humanitarian assistance, peacekeeping, and counterdrug/counterterrorism efforts.

Simulation and Command, Control, Computers, Communications, Intelligence, Surveillance, and Reconissance (C4ISR):
Joint Vision 2010 explicitly references requirements for enhanced modeling and simulation, including support of training with a "near-real-time interactive simulation between our forces in every theater," and notes that "we will pursue improvements in our campaign modeling and analysis to exploit the concepts of this vision." In contrast, it is not at all prescriptive with regard to C4ISR systems; there is, however, a Joint C4I "conceptual roadmap" document, "C4I for The Warrior," which serves this purpose.

Numerous documents, beginning with high-level Service "Vision" statements, cite JV 2010 as guidance. An example applicable to C4ISR is the Navy-Marine Corps "common vision" document "Copernicus: C4ISR for the 21st Century." The key principles defined are:

- Interoperability - Support for vertical and horizontal information flow
- Flexibility - Modular C4ISR packages and scaleable services
- Responsiveness - Information available that is current and in the right format
- Mobility - Able to move anywhere users go, and function under all conditions
- Survivability - Using multiple modes, dispersed facilities, and hardening as needed
- Sustainability - Providing continuous service for any type or length of operation

Major operational capabilities sought through the Copernicus initiative are:

- Assured Connectivity - Reliable access to timely transmission of imagery, video, voice, and data; described as "the enabler for dominant maneuver, precision engagement, focused logistics, and full dimensional protection".
- Common Tactical Picture - A shared, scaleable picture which can be tailored by the user to his specific needs, tactical situation, and level of command. The Common Tactical Picture consists of:
  - Inputs - Intelligence, surveillance, reconnaissance, identification, environmental, and positioning
  - Tactical decision aids
  - "Predictive modeling"

- Sensor-to-Shooter - An integration of capabilities supporting precision engagement: command, surveillance and reconnaissance, acquisition and localization, combat identification, targeting, engagement, and battle damage assessment.

An earlier version of the Copernicus document, available at the Copernicus website, contains passages that seem compatible with the vision and goals stated above:

Under "Command and Control":

> *"Decision makers can be given all available situational information; still, understanding the total scenario involves knowing why hostile forces are acting. When opposing forces engage in battle, it progresses at a pace set by each combatant's actions. C2 becomes difficult at best. Under such conditions, commanders must rely on training, doctrine and knowledge of the enemy. Knowledge goes beyond just situational awareness and includes the enemy's motives and doctrine. It is important that C2 systems have the capability to transcend situational awareness and free the commander for higher understanding tasks. Actions, visualization, collection and correlation drive the C2 engine toward understanding. Ascending the cognitive hierarchy will allow decision makers to create strategy, plan missions and rehearse based on an understanding of how the enemy is thinking."*

Under "Real-Time Mission Planning":

> *"When commanders conduct operations with a streamlined command structure and improved C2, there are mission planning implications. Mission planning maximizes the enhanced capabilities provided by advanced technologies. Increased intelligence in the mission planning process provides the mechanism for the sensor-to-shooter construct to build a mission planning capability into the launch platform, and even into weapons. Real-time mission planning allows weapon in-flight reprogramming, updating and terminal homing based on sensor inputs. Real-time mission planning is enhanced by M&S, which provides tactical commanders planning option alternatives based on scenario variables and produces rapid answers to "what-if" questions. Eliciting and storing details of mission plans is especially useful in the battle-cube when the shooter is relying on the system to provide executable plans for targets of opportunity."*

It may be significant that the current document omits reference to these rather ambitious goals, aside, perhaps, from the reference to "predictive modeling" within the Common Tactical Picture (which could denote something as simple as predicting the future location of a target based on its past history).

Advanced Battlespace Information System Task Force:
The Advanced Battlespace Information System (ABIS) Task Force was an initiative study conducted in 1996 and sponsored by the Director of Defense Research and Engineering (within OSD) and the Joint Staff (J-6). This study was initiated to consider command and control concepts and capabilities required to support Joint Vision 2010, and to suggest solutions likely to be technically feasible in the 2000-2010 time frame. The study involved some 130 team members, divided into three Working Groups—Battle Management, Sensor-to-Shooter, and Grid Capabilities, plus an Integration Team. Each Working Group suggested a series of worthwhile and increasingly ambitious "demonstration opportunities" which would likely become feasible during the study time frame. The task force focused on force employment, as opposed to deployment and other phases of operations, and did not consider logistics or other support

functions. It took a "clean sheet " approach which did not consider funding issues or (apparently) those systems currently fielded or under development. New "processes" as well as new capabilities were proposed, as suggested in this summary of work by the Battle Management Working Group:

> *"A primary goal of battle management in the integrated system concept is to achieve synergy between individual systems to achieve a significant improvement in performance. General improvement consists of decreasing the decision timeline (or increasing the enemy's) and increasing the quality of options assessment at any given decision point. Rather than merely looking for ways to accelerate the current process, the Battle Management Working Group developed reengineered processes to take advantage of advanced automated assistance and information access. Process changes are, in many cases, enabled by technology (e.g., virtual deployment and collaboration between dispersed forces).*
>
> *"The current battle management process involves sequential planning cycles that are typically 24 to 72 hours. Because of the complexity of the problem space, information acquired or assumed during planning often changes before or during mission execution. ISR and other tasking, such as in intelligence preparation of the battlefield, generally are based on "requests" for information, which in turn are based on assumptions of conditions during the operation being planned. In many cases, the warfighter may not even have visibility into the status of his request. In the reengineered process, a set of core processes ensures visibility, prioritization, and de-confliction of requests on a highly dynamic and interactive basis that crosses between current ops, future ops, and future plans. Planning, sensor management, and operations execution are driven by total visibility into ongoing activities, planned activities, potential activities, and their relation to the commander's strategy and constraints imposed by other planners. Using "command by prompting," conflicts are elevated to higher decision-makers for arbitration only when a conflict is detected. The important C2I capabilities are distributed across the forces in a way that interacts seamlessly across missions, echelons, and services."*

The proposed new processes most closely related to mission planning were:

- Continual Concurrent Planning and Execution - Characterized by each element operating on its own cycle in accordance with its own "operating rhythm," with all tasks coordinated by tying to a central strategy.
- Proactive, Dynamic Planning and Near-Real-time Re-planning - Based on projecting and assessing enemy and friendly likely courses of action, monitoring mission execution, and assessing the degree of mission accomplishment.

The Executive Secretary for the task force and the Director of the Integration Team was Dr. Dave Signori of DARPA. His ARPATech 96 briefing, cited below in the MITRE OPORD Study interview report, seems to reflect concepts arising from the ABIS study and suggests that those concepts have been considered in developing DARPA's own planning and C3 initiatives.

The ABIS Task Force defined a "Capability Framework" built on three successive tiers:

1. Information Grid - Consisting of the infrastructure and services which establish a supporting information environment.

2. Battlespace Awareness Capability - Consisting of:

   - Precision Information Direction - The ability to collect, process, and channel information to users in a timely manner and, conversely, the ability of the user to tailor his own information environment.
   - Battlespace Understanding - The "consistent and collaborative assessment of an operational situation and objectives."

3. Effective Force Employment - Consisting of multiple interacting functions, three of which were considered in detail:

   - Predictive Planning and Preemption - The capability "to preempt rather than react, to rehearse and evaluate possible futures, and adapt plans rapidly even during execution."
   - Integrated Force Management - The linking of staffs and warfighters to "manage dispersed forces and the synchronous execution of missions."
   - Execution of Time Critical Missions - The capability to rapidly acquire targets and execute attacks; includes sensor tasking, weapons assignment, and dynamic re-planning.

References:

1. Joint Chiefs of Staff, Joint Vision 2010; available in .pdf format at http:www.dtic.mil/jv2010/jvpub.htm
2. "1996 Advanced Battlespace Information System (ABIS) Task Force Report," briefing available at http://www.dtic.mil/dstp/96_docs/abis/abis.htm

Websites:

1. JV 2010 home page (www.dtic.mil/doctrine/jv2010/index.html); also provides access to Service "vision" documents.
2. Copernicus home page (http://copernicus.hq.navy.mil) -- Older version of Copernicus "vision" document is at http://copernicus.hq.navy.mil/documents/forward/copernicus.html; newer version is accessible as .pdf file at http://copernicus.hq.navy.mil/documents/index.html.

5. ANALYSIS AND RECOMMENDATIONS

5.1. SURVEY AND RESEARCH ANALYSIS

A significant portion of the effort involved surveying programs and people about the tools they use, they are building, or they believe would be of interest to this study. The most important findings are:

1. Very few computer-based tools exist for Joint planning and rehearsal (see Appendix F).
2. Most tools that do exist have been designed for a very specific use and therefore have very narrow application domains
3. Existing tools are not interoperable since they typically were not designed for any other applications. Consequently, they have not been integrated into other C2 or simulation applications.

One of the most surprising revelations was that manual planning processes still tend to be the primary method at most command echelons in the DoD.

Very few tools uncovered during this research are applicable to the Joint environment. Portions of GCCS address Joint applications but do not cover the entire spectrum targeted by the study. JSIMS is required to support Joint missions, but at the time of the interview, the program had not delivered working subsystems. DII-COE requirements for mapping and the common operating picture are beginning to bring some Service C2 tools together. Examples of these DII-COE requirements are visible in programs like MCS, JMTK and some research efforts like the DARPA COAA. Some programs are working towards Joint solutions, but most tools are not capable at this time.

Many new planning tools are not being designed with a truly Joint capability, due in large part to a need for more funding to develop the necessary Joint functions. The Services still fund nearly all programs with specific allocations from each Service budget, even if the program is Joint. There is also sometimes a tendency for the lead Service to give priority to issues of interest to that Service.

An interoperability problem exists in all of the C2 realms that this study addressed. An enormous amount of effort and money are currently being focused on general C2 interoperability issues. This huge DoD and industry effort seems to be focusing primarily on the real world communications problems. In parallel with these efforts, a follow-on this study can contribute to automated planning, data presentation, and data collection tools at the middle and lower levels of the military planning processes.

Since manual processes are still used, current technology can be applied to capture these processes at each echelon. The solutions could be implemented today with minimal modification to the processes, other than technological enhancements for data collection and presentation. Significant anecdotal information suggests many limited attempts have been made in this area. More research could identify lessons learned under previous efforts and implement a simple, easy to use, automated process.

5.1.1. Need for Joint Processes and Tools

The interviews and research clearly indicate a need for Joint planning, mission rehearsal, and mission execution processes and tools. Current tools do not support Joint coordination, but this issue is beginning to be addressed. Creation and integration of tools that support the Joint communication and Joint coordination tasks are close to making the current funding requirements, but once funded these products will take several years to be fielded under current programs.

Enhanced Joint mission planning tools are required and need to be developed. Some Joint planning tools exist at higher echelons (for example, at the NCA level and within the GCCS programs for each of the Services), but these tools do not extend very far down into the command and planning structure. Equally important, these tools must be more tightly integrated with the other Joint C4ISR systems at all echelons. This study did not identify formal documented requirements covering this specific problem domain, but portions of these requirements are being addressed by existing programs. Unfortunately, there does not seem to be any coordinated of the efforts among these programs that are each working some aspects of the problem.

Integrated mission rehearsal tools appear to be virtually non-existent today. There are several confederations of simulations that provide some functionality, but they currently require extensive efforts to implement and manage. Most of these simulation systems require very specific scenario development. Generation of these scenarios is very time consuming and labor intensive. Since mission rehearsal can be viewed as an integrated function of future C4ISR processes, there are significant opportunities for development and integration of mission rehearsal tools with C4ISR systems. Significant pockets of technology exist today in the simulation field that could be applied to this domain. In particular, simulation technologies can be readily applied to C4ISR mission rehearsal problems to provide significant near-term benefits.

Current C4ISR development and upgrade programs are partially addressing the execution evaluation problem. One of the primary goals of current developments is to provide a Common Operating Picture (COP) at all command echelons. This common view of the world provides the first step toward effective evaluation of military situations. The next step is to use automated evaluation tools to assess COP relative to the planned course of action and contingencies. Incorporation of dynamic COAA is the next logical step for enhanced C2 performance. Feedback mechanisms and user interfaces provide input and output opportunities for the human in these processes. COAA and execution evaluation are heavily dependent on human decisions, making commanders and planners integral to these processes.

There appears to be a need for tools to support a continuous planning, rehearsal, and execution monitoring and evaluation process for future high-speed warfare. This continuous process would allow the earliest possible detection of problems and enable decisive action to be implemented as soon as possible.

5.2. ENHANCING THE MILITARY DECISION-MAKING PROCESS

This section describes the relationship between new mission planning/rehearsal tools and the basic steps of the military decision making process. An outline of how the new tools could enhance the MDMP is presented.

Figure 5-1 presents the major steps in the planning, rehearsal, and execution monitoring phases for the Army as defined in the military decision making process. This figure is reproduced from FM 101-5.

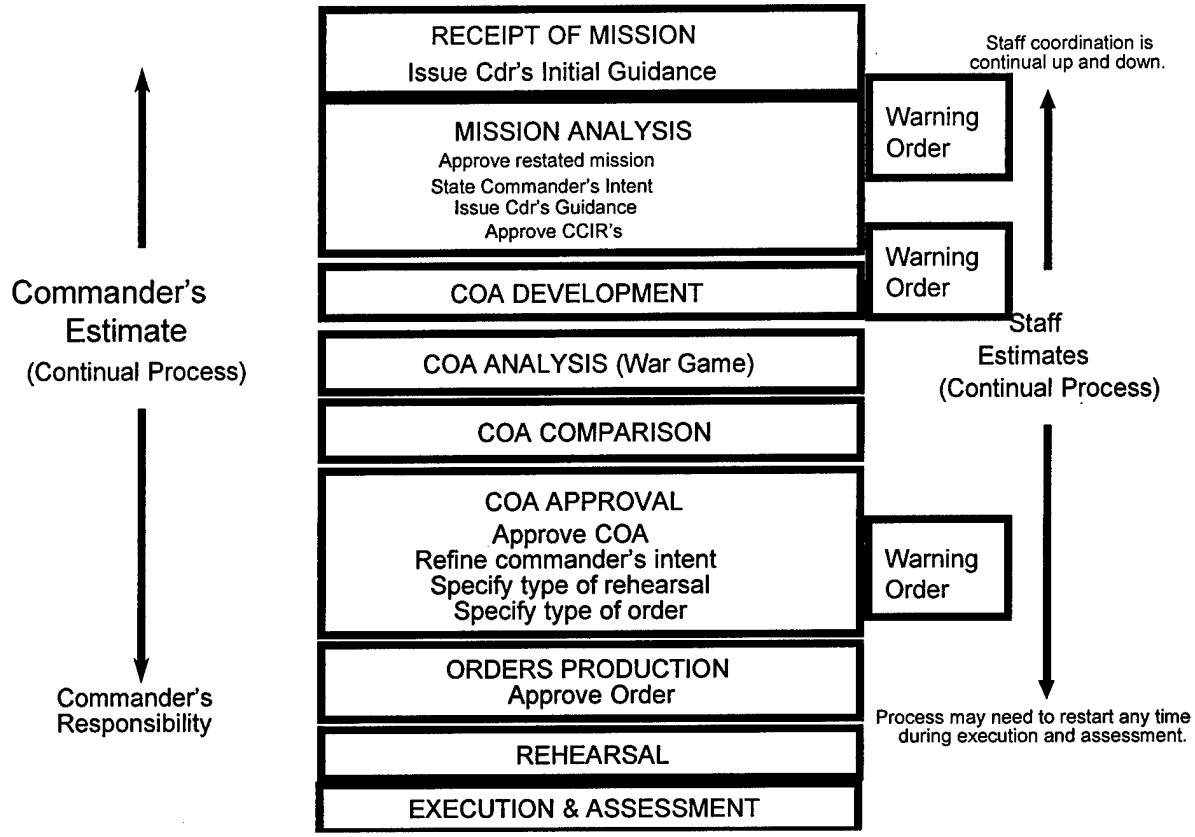

Figure 5-1 -- Military Decision Making Process

The first step of the planning/command process begins with a new mission, as assigned by a higher headquarters or conceived internally in response to a new situation, and involves generating the commander's initial guidance to his staff. All of the commander's initial guidance must be captured during this phase to ensure its adequate consideration during the remainder of the planning process. It would be useful at this point to have tools which would capture the mission and commander's guidance in an automated fashion. At many echelons, this process is completely manual and needs to be enhanced to allow the follow-on phases to be processed via automation. It is probable that some of the COAA tools could interface with this initial planning process. MCS, sand tables, and other C2 planning tools are prime candidates for technology investigation.

After the initial guidance is captured, portions of COA analysis and development tools can be employed for the mission analysis portion. Enhanced tools could capture the nuances of the mission development and planning processes. As much information as possible needs to be captured and organized in this phase, since this leads to better understanding of the mission and constraints later in the evaluation process. Complete capture of the planning data provides better support for the Commander's Critical Information Requirements throughout the process. Simple tools that mimic the current processes are critical. Organized and simple automated presentation of the planning data is one of the top requirements for this set of tools. Figure 5-2 presents an overview of the most important inputs and outputs used in the MDMP.

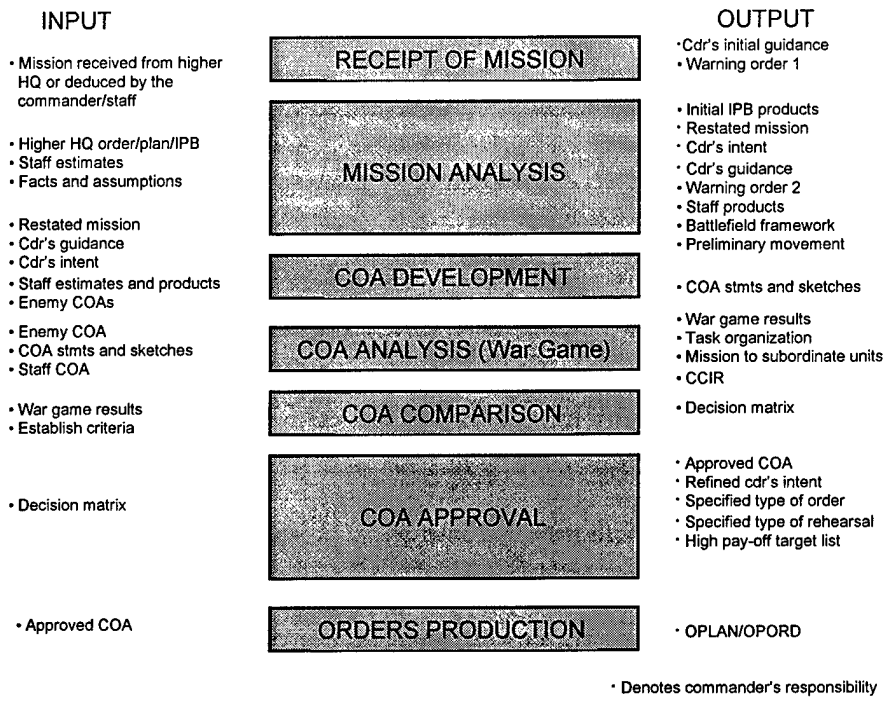

Figure 5-2 -- MDMP Inputs and Outputs

Next, methods need to be defined to interface the automated mission guidance, CCIRs, and supporting data with existing COAA tools. It is quite likely this activity would be a collaboration between the COAA team and the MCS outboard experimentation team. MCS requirements can use the experience from this program and COAA to enhance the delivered MCS product. Likewise the COAA products can benefit from the automated data input.

The following three steps, COA Development, COA Analysis, and COA Comparison are the heart of the COAA tools. These steps use the data provided from the earlier data capture steps to define COAs that meet the mission requirements. The COA Analysis portion of these steps would be augmented with enhanced modeling and simulation processes. Since mission rehearsal tools will be a focus in later processes, ways need to be defined to use these same rehearsal tools as the simulation engine for the COA analysis. Most of the same real-world data is required to perform analysis or rehearsal, so the processes should be nearly the same. It should be noted that this set of processes is iterative and ideally would be running nearly continually to define the best set of COAs for the next phase of the mission. Likewise, continuous evaluation and re-evaluation are required.

Automated tools are needed to quickly compile, compare and contrast the data that is generated during the COAA process and to convert it into effective presentations for command decisions. Another major sub-step in this phase is the definition of the type of rehearsal (or rehearsals) that needs to be performed. The planning tools must highlight the conditions that affect this rehearsal decision, as well as support quick implementation and management of scenarios for rehearsals.

Upon selection of the COA, operation orders or plans for must be created. Automated tools are needed to shorten the timeline for this process, some of which are part of new C2 systems, and some need to be

developed. MCS or other C2 systems can be used for portions of this task as well as some outputs from the COAA tools.

Once the orders are completed and distributed, the formal rehearsal phase is entered. This phase can be extremely short or very extensive depending on the mission details and other constraints. Various types of rehearsals can be performed at this point, depending upon the time and staff available. The range varies from a commander's verbal or white-board walk-through to a detailed simulation-driven rehearsal which could include most of the troops. A robust and flexible set of tools is needed to meet this broad requirement.

The WARSIM Test Bed is an example of a focal point for research into mission planning/rehearsal tools. Highly aggregated simulations, command analysis simulations like those run at the Armed Forces Staff College, and entity-based simulations like ModSAF, can be used to refine the functional and performance requirements for planning/rehearsal.

There are five major rehearsal types used in the MDMP: the confirmation brief, back brief, combined arms rehearsal, support rehearsal, and battle drill or SOP rehearsal—portions of each of these must be addressed since they are all required in certain situations. The confirmation brief allows the subordinate leader to express an understanding of the mission plan as it has been delivered. This may be provided in the automated planning and order delivery tools. The back brief is an ongoing process that allows a commander to identify problems throughout the process. This back brief is provided by clear communications channels between the subordinates and the commander. Combined arms rehearsals are usually conducted by maneuver unit headquarters and after the subordinate units have issued their OPORD. They are used to make sure units' plans are synchronized and that the subordinate commanders' plans will achieve the mission intent of the higher commander. Support rehearsals are usually conducted by particular operating specialties and are conducted throughout the MDMP. The support rehearsals ensure each particular operation will support the mission plan and goal. The battle drill or SOP rehearsal is used to ensure that all participants (at the appropriate echelon) will understand a particular technique or a specific set of procedures. Portions of these rehearsal types will be incorporated in C2 systems, simulation engines, and planning automation tools as research and experimentation progress.

Figure 5-3, from FM 101-5, shows the rehearsal techniques typically used by MDMP. Appendix G of FM 101-5 provides an excellent reference on the types and techniques of rehearsals typically used in military operations. Army, other Service, and Joint planning doctrine needs to be used throughout the research, experimentation, and development of the tools. It should be noted that these rehearsal techniques and tools must also provide the basis for individual training at the execution end of the command chain.

As shown in Figure 5-3, the techniques for rehearsals depend heavily on the amount of available time and specific unit procedures. Various issues determine the appropriate technique, but the MDMP requires consideration of time, the number of echelons that can participate, operational security (ease of enemy gaining intelligence from the rehearsal), and terrain management considerations. The evaluation of these factors typically defines the technique employed.

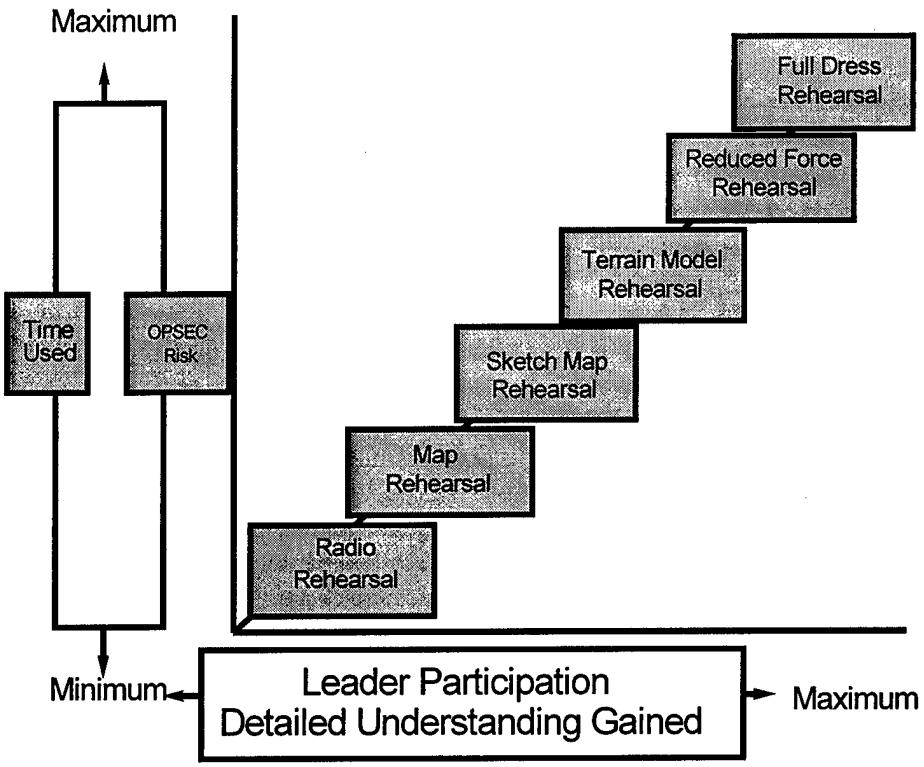

Figure 5-3 -- Rehearsal Types

The six major rehearsal techniques available are full dress rehearsal, reduced force rehearsal, terrain model rehearsal, sketch map rehearsal, map rehearsal, and radio rehearsal. Terrain model rehearsal is the most common technique used in the Army today, and should be one of the initial key targets for planning/rehearsal tools. Rather than providing physical mock-ups of the terrain to be used during execution of the plan, modeling and simulation technology could be applied to enhance realism and decrease time requirements for preparation. Once the basic terrain model rehearsal tools are developed (or adopted from other programs like MCS or ASAS), other rehearsal techniques can be targeted. Sketch map and map rehearsals should probably be provided as natural adaptations of the automated sand table and other planning tools.

A continual focus must be maintained on enemy COAs and adversarial planning during the tool research, experimentation, and development. Without tools to address enemy options, the planner would be automatically placed at a disadvantage. Therefore, equivalent processes for the enemy must be incorporated throughout the planning process. These enemy tools must be adjustable to accommodate varying enemy doctrine, force capabilities, etc.

The generic rehearsal events defined in FM 101-5 must be considered during research, development, and integration. First, ground rules of the plan must be reviewed and understood by all participants. Next, the tools must adequately present the deployment of the enemy. Both known and speculated enemy locations should be included, and the interface would allow user modifications of the enemy locations and strengths. Automated connections to C4ISR databases should be implemented wherever possible. Likewise, the deployment of friendly forces needs to be represented, modifiable, and automatically

updated where possible. Advancement of the enemy must be postulated and represented in truth as it is known. Continuous evaluation must be performed to determine if a decision point has been reached in the plan. The evaluation of decision points applies to both rehearsals and continuous execution monitoring phases. Once the decision point evaluation is complete, a branch must be executed if necessary, advancing then to the next decision point while updating all factual (or postulated) data. The process will continue until the end-state is reached for the rehearsal or executing operation. In the rehearsal case, the rehearsal tool is reset and a review is held to determine what was learned and to improve the plan if possible. In the execution monitoring case, an after action review may be held to identify the positives and negatives from the mission. Both the rehearsal and execution evaluation tools can be used for the education of commanders and subordinates.

Finally, the embedded training tools can use all of the MDMP processes to enhance the skills of the trainee. Each of the applications mentioned above should be implemented in the training application to enhance decision-making skills.

5.3. REQUIREMENTS FOR TOOLS FOR MISSION PLANNING, REHEARSAL, AND EXECUTION MONITORING

5.3.1. Generic Requirements

The study identified seven generic requirements for mission planning, rehearsal, and execution monitoring domains. These are not necessarily validated Service requirements, but rather items interpreted from the research data and interviews. These requirements are:

1. Automate the current manual planning processes (as they exist today) at all appropriate echelons.
2. Provide tools that are extremely easy to use.
3. Provide tools that are extremely easy to learn.
4. Do not hinder any group planning or evaluation process dynamics (maintain the valuable human to human interactions).
5. Create tools that operate on existing equipment. (This requirement is more applicable at lower echelons than upper echelons.)
6. Provide tools to capture All of the data available during the planning and evaluation processes (voice, notes, discussions, arguments, etc.)
7. Provide sets of tools that meet both the common and the unique planning and evaluation requirements for their particular echelon.
8. Complement and leverage tools and related technology activities that are already under development.

One of the recurring interview comments was that future tools must be extremely easy to use. Since the current planning tools at many command echelons still require maps, sand tables, crude mock-ups of terrain, etc., new tools must be as easy or easier to use than grease pencils, acetate overlays, and yellow sticky notes.

This list is not an exhaustive list, but rather the common requirements identified during the research. Several items need additional clarification. In item five, all tools provided should be designed to operate on existing equipment wherever possible. This is especially important as you get nearer the lower echelon commanders and planners, since they must be able to deploy and maneuver; moreover, there is already too much equipment required for most echelons, and the military cannot afford additional

hardware. Item six probably presents the most significant technological challenge. It requires complete data collection and capture in a very dynamic environment. This environment includes multimedia and many different types of interactions.

Implementation of new tools could begin quickly by initially focusing on the automation of simple basic planning processes. Additional refinement is necessary, but the basic goals are identified. A simple application like an automated sand table allows the team to develop early prototypes, define some direct user contacts, show physical results, and highlight some immediate benefits early in the effort.

5.3.2. Tools and Technologies to Support Automated Planning Tools Development

Current Joint Tools:
There are many existing tools that are relevant to this development plan. The Joint common tools in development today should be considered as the leading candidates for displays, map backgrounds, overlays, standard icons, and the general Joint common operational picture (COP) that DII-COE is striving towards. Tools like the JMTK, DII-COE COP, JOPES, GRIS, GSORTS, RDA, LOGSAFE, JMCIS, TARGET, JEPES, JDISS, Common Message Processor and others provide opportunities for re-use and lessons learned.

Terrain Data:
Terrain database options must be examined. Common standards should be used from the C2 and modeling and simulation communities wherever possible. This research may identify SEDRIS or other developing standards as potential solutions for terrain representations. All options must be researched in this particular area since warfare planning depends very heavily on the representation of the area of interest.

Route Planning:
Route planning tools are key portions of certain planning tools. The types of tools developed in the modeling and simulation world and the C2 world must be examined in the requirements development phase. It is possible very innovative solutions from both realms can be combined.

Intervisibility:
Intervisibility and line-of-sight tools have also been developed in both the C2 and simulation communities. A comprehensive study of the algorithms and techniques must be performed before best options can be selected. Simulation tools may provide enhanced capabilities that the C2 planners are not aware are currently available.

Other Planning Tools:
There are many additional requirements for the planning process. An initial iterative tool prototyping phase would identify the most important planning requirements and continue a more detailed analysis of the tools being used today. The best available features from each tool set should be applied wherever possible.

5.4. DEVELOPMENT OF MISSION PLANNING, REHEARSAL AND EXECUTION MONITORING TOOLS

5.4.1. Simple Automation of Existing Processes

The military personnel who participated in this study consistently expressed frustration with the lack of the simplest map-based planning tools. They also expressed reluctance to abandon the basic approaches to planning that have evolved. To keep a sense of familiarity, provide focus and garner end-user support, the initial development of tools should capture the military planning process as it exists today. Three guidelines are crucial for success of these tools:

1. Support the current planning processes as they exist today as much as possible.
2. Keep the user interface simple and easy to learn.
3. Continue to encourage the dynamic group planning process.

The initial tool set development should focus on computer based maps and sand tables to assist planners. A simple interface can be provided to all maps in use today. This tool would require access to a map server in a TOC or the equivalent, and would provide maps/terrain at all scales typically used today. Map registration issues must be addressed, including the datum, coordinate systems, and other features desired. Current C2 tool development programs, as well as previously created "home grown" solutions, need to be examined for existing solutions in this area. Wherever possible, the tools must be DII-COE COP compliant. Where ever feasible, the common tools being developed for displays, maps, and overlays should be used to comply with DISA Joint requirements.

These tools must be easy to use and must provide all of the typical manual planning devices employed today, but created in an automated fashion. The basic functions required include troop placement, overlay creation, general battle flow, and many others. Systems such as MCS must be evaluated for their contributions to planning tools; situational awareness is a current thrust of their development, making them a very likely source of mapping, overlay, and placement tools. Options must be provided to support planning for each echelon to address the planning and rehearsal goals for staff below the top command echelons.

The simple planning tools also allow the team to capture unique but Joint requirements at several echelons while developing proof of concept systems. This solid foundation will provide the initial building blocks for enhanced tools. Success in the early phases will enhance user support and increase the probability for future successes.

Some possible locations to develop initial user support are the Central Technical Support Facility at Fort Hood, Texas or the Marine Corps Modeling and Simulation activity at Quantico, Virginia.

Commercial laptop computers are well-suited for the first versions of these simple planning tools. Where appropriate, the tools can be linked to existing C2 systems to complement their capabilities. To meet the typical planning team requirements, it is likely that the tools would eventually incorporate a large display or projection device.

5.4.2. Plan and Design Interfaces Between Planning/Rehearsal Tools and C2 Systems

After the initial planning tools are defined and under development, a significant amount of attention must be given to interfaces to real world C2 system. While the interfaces must be a key consideration from the start, this activity would become one of the top priorities one a set of prototype tools is available for integration.

There are three leading candidates for the initial C2 portion of the design. These are MCS Block IV, WARSIM, and the DARPA COAA activity. These activities should provide the core for all follow-on tools. MCS has a programmatic opportunity to perform experiments as the development continues. WARSIM is the targeted mission rehearsal system for MCS and is currently developing test software in a prototype laboratory. This provides natural opportunities for experimentation without disrupting production programs. The DARPA COAA program has developed an engine to evaluate COAs. Since planning requires alternatives, this key function should be embedded in the basic tool set as soon as possible. Other systems can be added when viable candidates are identified. MCS, WARSIM, and the DARPA COAA program cover the three main areas (planning, rehearsal, and execution monitoring) to be addressed.

The interfaces between planning and C2 systems are high risk areas for existing C2 developments. Many of the planning and rehearsal requirements, although present in the C2 system requirements, are not high on the development priority list and are presently being deferred in developments. The C2 system developers are focusing on the core C2 operational requirements first.

5.4.3. Develop Basic Interfaces to C2 Systems

Similar to the development of the basic planning tools, only basic interfaces should be implemented to C2 systems at first. The communications mechanism should use a common language or database exchanges that will continue to be supported in the future. Translations and middleware should be minimized wherever possible. Some web-based technologies may be very applicable at this point.

The highest priority planning data interface should be designed and implemented in the initial subset of exchanges. Data supporting troop placement (by the users of the system), troop location, intelligence data regarding the enemy location and strengths, common maps, common terrain databases, common overlays, and other common planning tools should be implemented and tested early in the development.

To complement MCS, ASAS, FAADC2I, and other similar Army assets in ABCS should also have interfaces for improved planning tools. Some of these interfaces may already be available through MCS and others will require additional development. All existing planning tools should be analyzed for re-use.

5.4.4. Interfaces to C2 Systems

During development of the basic tools, interfaces to relevant C2 equipment must be assessed, with due consideration being given to the extensive changes in progress in the C2 area at present. It is assumed that most C2 interoperability issues will be resolved by the many programs currently funded to do so.

At a minimum, the basic connectivity between mission planning/rehearsal/monitoring tools and C2 systems must provide friendly and enemy resource lay-downs on the maps or displays. This requires the planning/rehearsal tools to tap into C2 databases. The work accomplished by various DoD programs that are currently studying common database representations should be leveraged to avoid duplication of effort. Part of the research in this area will be to identify appropriate Joint tools for various command echelons.

Key issues for this phase of development will be:

1. Integrate common existing tools wherever possible.
2. Make the interface design expandable and reusable.
3. Keeping the interfaces as simple as possible.

5.4.5. Enhance the Interfaces Between Planning, Rehearsal, and C2 Systems

Once the basic interfaces and tools are developed, integration and further system development can begin. A truly Joint system must fulfill the requirements for each individual phase of the planning, rehearsal, and execution processes. A initial simple integration of tools and C2 systems could evolve into a more structured spiral development of a system of systems to produce a rich set of Joint tools.

5.4.6. Interfaces with Higher Echelon Planning Tools

Many higher echelon C2 planning tools are already automated. GCCS in its Service variations already captures some of the information necessary for mission planning/rehearsal/monitoring. Once the lower level planning tools exist and the basic interfaces to C2 databases are provided, developers must ensure that all tools maintain consistent data. GCCS and the existing lower tier C2 systems must be connected and tested with the Joint tools. Integration of the tools with the C2 systems should leverage the DoD and Industry work that has been done in this area. Risk reduction factors should be a prime consideration during the entire effort.

5.4.7. Investigate Requirements for Simulation Technologies

Since one of the major goals is to integrate technologies to support planning, rehearsal, and execution monitoring, the effort must research and analyze potential supporting technologies. The modeling and simulation domain has developed some very significant technologies that can support C2.

Semi-automated forces technology has created many algorithms for route planning and mobility analysis based on detailed terrain features. These algorithms, as well as traditional planning algorithms, should be assessed to determine there applicability. For example, many graphical user displays are already available in the simulation technology and may be completely applicable for mission planning and mission rehearsal. Likewise, the modeling and simulation domain has performed significant research, experiments, and implementations of three-dimensional terrain, three-dimensional visualizations, and planning for computer generated forces. Many of these tools could be directly applicable for the C2 domain. Developers must take advantage of simulation-created tools and other candidate technologies.

Some issues to address in this research are:

1. Use common mapping tools between planning, rehearsal, and execution monitoring
2. Avoid special purpose or high cost 3D visualization hardware
3. Provide visualization tools in 2D wherever possible to avoid the 3D expense

    - 2D line of sight tools for communications
    - 2D line of sight tools for visual/sensor blockage

- Terrain visualization (go, no-go terrain for example)

4. Provide adequate Dynamic Terrain Representations (2D and 3D)

   - Dynamically update conditions of bridges, roads, airfields, rivers, ports, etc.
   - Dynamically update the status of buildings, trenches, craters, rock drops, etc.

5. Provide Dynamic Virtual Worlds

   - Emulate varying conditions of weather, fog, snow, waves, tides, moonlight, etc.

This effort provides a unique opportunity to bridge the gap between the operational C2 community and the modeling and simulation community. To take full advantage of this opportunity, the best tools and techniques from both communities must be examined. The best solutions or tools from each should be considered and where feasible adopted for use.

5.5. ADVANCED EMBEDDED TRAINING CONCEPTS

The original concepts for mission planning and rehearsal tools developed from embedded training plans. New planning/rehearsal tools are likely to span a large portion of the Joint planning, rehearsal, and mission execution tasks for DoD, and thus generate a requirement to conduct training on the use of the tools. The tools could be distributed and operated on equipment available at each echelon. This distributed nature of the tools is well-suited to embedded training, whereby all of the training processes can run individually. This section of the paper examines some of the direct and indirect training issues.

5.5.1. Individual Training Device

Any training devices must operate on the unit's own equipment. The concept of training on the same device is consistent with the latest DoD concepts of training with actual operational equipment. The training tools must be extremely easy to use. Each tool must be very interactive. To gain the most benefit, the training devices must be tuned to the capabilities of the trainees and the specific requirements of their individual specialties. The training devices outlined here, although tailored to staff personnel with planning responsibilities, could be adapted to other specialties such as tank drivers, artillery operators, and logistics and communications specialists.

5.5.2. Approach for Embedded Training Device

There are many ways embedded training can be applied. An approach for training to use the new tools is outlined below.

1. Use Computer Based Training/Testing (CBT) to determine the trainee's expertise and level of proficiency.
2. Automatically create a scenario/simulation that exercises the weaknesses identified in the initial testing.
3. Automatically evaluate the trainee's performance during the scenario and point out weaknesses/improvements.
4. Retest or retrain on a new scenario based on the previous performance evaluation.

In the first training step, the trainee is given a short test to determine his or her strengths and weaknesses in the specialty area. A trainee could, for example, be a battalion planner focusing on intelligence. The

test could provide multiple choice questions that are difficult enough and interactive enough to determine the level of expertise of this person. This type of test is used by the Graduate Record Examinations and more information about this form of testing can be obtained at http://www.gre.org.

Once the multiple-choice test is evaluated, a scenario can be generated automatically that incorporates decision points related to the weaknesses identified during testing. This capability requires incorporation of CBT and simulation technologies. Likewise it requires creation of an agent that can create scenarios from the test results. Scenario creation could use DoD doctrine, commander's guidance (real or simulated), mission specialties, planning tool outputs (logistics, specific orders, ROE, etc.), and other data to create the variations.

Next the trainee would run the scenario on his or her training device. This device would eventually be the same tool as trainees use operationally. As the trainee takes actions during the training scenario, the training tool will evaluate the performance and adapt the remaining scenario as required. Adaptive simulation technology and CBT techniques could be easily applied.

Upon completion of the training scenario, an automated trainer agent would automatically grade the performance of the trainee. A summary score, impact on the mission, impact on the unit, impacts on the supporting and supported units, and other measures of merit can be delivered to the trainee. A replay mode could be selected to walk back through the scenario and highlight the best alternatives at decision points where the specialist selected a sub-optimal option. If desired, the scenario could be played with the best decisions being made automatically as a review device. This best decision mode could provide enhanced user experience. Note that this is nearly the same tool required for the mission rehearsal portion of the operational tool set.

At the end of a scenario the training tool can present recommendations. Further training could be recommended for this type of scenario or additional scenarios could be encouraged to cover other weaknesses identified in the initial testing. If the trainee performed very well, no additional training could be recommended. An additional test could be suggested to uncover other weaknesses or create harder scenarios for more advanced students. Goals of this tool would be to make the training experience fun, educational, accurate, and readily available for the soldier's existing equipment.

5.5.3. Scenario Scope

The scenario for the embedded trainer should initially be limited to short term activities for the trainee. Short term is defined by the trainee's specialty area in this case. Likewise, the scenario should focus on the immediate area of interest for the trainee. These limitations simplify the scenario creation and limit the data required from other operational systems. Large training systems like WARSIM and JSIMS are required to simulate all aspects of the battlefield, whereas this embedded training capability is supposed to function in a stand-alone mode as much as possible. After the technology is developed, it is possible distributed processing and other advanced technologies can enhance the scope of these individual-training devices.

All locally available data should be combined with agent-created inputs for those aspects missing, in order to create a complete practice scenario or set of scenarios. When the device is connected to databases containing real mission information, the real information should be used as much as possible. If real orders or a real situation is not currently available in the databases, pre-defined scenarios can be provided to meet the typical missions expected by the specialist being trained.

5.5.4. Teacher Agent

A teacher agent could be used to implement this embedded training. It would incorporate the guidance and knowledge of doctrine, mission specialty, real world constraints, and many other factors to evaluate the trainee's performance. One promising technology in this domain is the Cognition Oriented Emergent Behavior Architecture (COREBA) effort being performed for the DARPA JFACC program and the USAF Air Force Research Laboratory.

5.5.5. Training Device Platform

A laptop computer would make a good target training device. Once tools are developed and function appropriately in this environment, the tools could be transferred to existing military platforms, or operated as supplementary subsystems on local area networks. Eventually this technology would be ideal on whatever personal computing device each operational specialist typically uses.

Once the training device is ready for operational equipment, the applications should be transferred directly to the embedded tools and user interfaces for their particular specialty. Touch screens and other state of the art technologies like eye trackers should be considered. It is possible some technology from the Navy Aegis training program could be incorporated in the development of this training device.

Initial trainer versions may not be DII-COE/COP compliant, but all future versions should target DISA JTA requirements for the enhanced applications. Once the trainer conforms to the operational requirements, it should be incorporated in all existing platforms as an embedded trainer, decision aid, and proficiency trainer.

5.5.6. Training Tools as Decision Aids in Operational Situations

These training tools could also be used as decision aids in operational environments. The evaluations are performed based on doctrine, mission guidance, current situation inputs, and other factors representative of the mission and goals. Therefore, the outputs from the evaluations should provide valid options for the specialist. Once again this embodies the "train as we fight" goal of JV 2010.

To meet this decision aid task, the user must have a very simple and easy method to enter or update the operational situation. (This reflects back to the initial development phase recommended for development of basic planning tools.) Likewise, the decision aid should automatically be updated with all relevant operational information available. This could include information from all of the C2 systems and other DoD databases available to that particular device. (This points to the relevance of common databases again.)

As the mission evolves, a prioritized list of options, as evaluated by the decision aid, could be provided. The evaluation will be based on the situation, doctrine, planning outputs, commander's intent, and other pertinent data. Options presented could be reviewed, selected, or ignored by the specialist as he or she deems appropriate.

The decision agent can draw on research from other DoD programs and from contractor research. For example, the COREBA architecture is being used on the JFACC program to incorporate evaluation and decision agents for the commander. Tool development needs to couple efforts with these programs to reuse research and technologies that are appropriate.

For accurate decisions, the decision agent will probably need access to high quality terrain data for many specialties. This will require a simple, low cost, low bandwidth method to transfer terrain data to the user device. One option would be to use current and future C4I terrain format research and standardization. It is likely that the tools will have to interface to C4I terrain data in these formats.

5.5.7. Benefits of Embedded Training/Decision Aids

The foundation for these decision aids and embedded training aids starts with the basic planning tools, but the end result could present much more. The decision aid and training tool provide an opportunity to merge modeling and simulation, training concepts, computer based training, mission rehearsal, and mission execution monitoring into a single package. This package could ultimately be embedded in the end user device. This tool could provide a unique training opportunity for each mission specialist if it is applied to many specialties. It also can provide the foundation for distributed training on the battlefield. Once the basic training agent technology is established, it is quite easy to imagine collaboration among the agents as today's distributed simulation technology is applied. This is one of the greatest potential benefits of the embedded training plan.

5.5.8. Simulation Based Tools Add Realism

Embedded training tools can begin with two-dimensional representations for expediency. These simulation-like representations can be designed appropriately for each DoD job specialty.

An expansion capability should be planned for these tools as part of the initial design. Enhancements could be implemented to allow better training using three-dimensional technology, sound, and other enhancements to create realism for the trainee. Standard laptop and desktop technology could drive these enhancements.

5.6. EXPERTISE AREAS TO CONSIDER DURING TOOL DEVELOPMENT

Many different aspects must be considered under the development plan. The list below captures some of the areas identified from Army doctrine that must be considered. This is not an exhaustive list of all items to be considered, but provides a template for many important disciplines in the military planning process.

Specialty Areas to be Considered:

- Intelligence
- Maneuver
- Fire Support
- Mobility and Survivability
- Air Defense
- Information Operations
- Combat Service Support
- Command and Control
    - Rules of engagement

- Command Post positioning
- Position of the commander
- Communications asset location and protection
- Liaison officer interactions
- Force protection measures
- Time line guidance
- Type of orders and rehearsals
- Specific guidance

APPENDIX A - CONTRACT EFFORT OVERVIEW

An Integrated Project Team (IPT) approach, involving government and Lockheed Martin participants, was used for this effort. IPT members are listed in Section 9 of the report. An initial team teleconference was held on 15 July 1998, shortly after issuance of the Delivery Order (9 July). Teleconferences were held thereafter at roughly two-week intervals. A meeting of the full IPT was held on 19-20 August at the Lockheed Martin Information Systems facility in Orlando. Minutes were generated for this meeting as well as for all teleconferences, and were forwarded to all team members via email.

The IPT developed the following Mission and Vision statements:

Vision:
Define and demonstrate selected methods and means to interface with command, coordination, and intelligence systems to enhance commanders' understanding of the battlefield and the effectiveness of the planning necessary to control it.

Mission:
Support the next generation of command, coordination and intelligence systems that are envisioned by Joint Vision 2010. The goal is for commanders and staffs to rapidly, and effectively, conduct Joint and Service operational mission planning, rehearsal, and execution monitoring.

The effort will identify technological challenges to Joint and Service operational planning, rehearsal, execution monitoring, and staff training processes. It will further identify relevant technologies to enhance the decision-making processes within current and future command, coordination, and intelligence systems. It will support the development of next-generation tools and processes for commanders and staffs to achieve the concepts embodied within Joint Vision 2010.

The following capabilities will be addressed:

- A common, multi-layered tactical picture of the current and planned situation.
- Enhanced decision aids, enabling the commander and his staff to quickly and effectively prepare a plan, rehearse the plan, monitor the execution of the plan, and iteratively re-plan.
- Multi-echelon information management tools enabling commanders to have a unified view of the plan and the current situation.
- Command and coordination capabilities to rapidly create a unified situation assessment from disparate sources and coordinate the execution of a plan across echelons.
- Crisis action planning and rehearsal.
- Embedded staff training.

Key discriminators of the effort will be:

- Focus on the needs of the commander.

- Joint and Service functionality improved planning and decision making tools.
- The ability to plan and execute faster than the enemy can plan (turn inside the enemy's decision cycle).
- A common system supporting training through execution (train as we fight).
- Facilitating a continuous and iterative planning process.
- Collaborative planning and execution tracking.

Basic assumptions underlying the effort are:

- This effort will incorporate current doctrine and the concepts put forth in Joint Vision 2010.
- Initially concentrate on Army and Marine processes.
- Not create a new C4I system nor solve existing intercommunication problems among such systems.
- Decision aids for training and operations are fundamentally the same.

- Leverage technologies and products whenever possible.

For the IPT as a whole, the major portion of the total effort was expended upon developing a list of applicable programs and activities, determining accessible points of contact for interviews, scheduling and conducting those interviews, and summarizing the findings. The interviews conducted constituted a prioritized subset of a very long list of applicable candidates, given the broad scope of the study area. Interviews were conducted, either in person or by teleconference, by 2-4 team members, using a standardized list of questions (Appendix A) tailored as appropriate to the subject. Interviewees were provided with a short presentation, based on the vision and mission, to provide a context for the interview.

APPENDIX B - APPLICABLE DOCUMENTS

GOVERNMENT

ADST II Statement of Work for Embedded Mission Rehearsal Analysis, 22 June 1998, AMSTI-98-W050, Version 1.0.

NON-GOVERNMENT

NONE

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APPENDIX D - INTERVIEW QUESTIONS

General Program Questions

1. Does your program, project or system relate to EMPiRE as we have described it?
2. Is the program funded Jointly or by the Service(s)?
3. What service is the lead acquisition service?
4. What is the program office coordinating the effort?
5. Who is the prime contractor? Who are the major sub-contractors?
6. Was the system originally intended as a Joint system? Is it currently envisioned as a Joint system?
7. What is the program schedule? Estimated Initial Operating Capability?
8. How does your program, project, or system relate to mission planning, rehearsal, and execution activities? Is it associated with any specific initiatives for the future in these areas? If so, are these Joint initiatives?
9. Does your program/effort incorporate mission planning, mission rehearsal, and mission monitoring/execution tasks? What are they?
10. If yes to preceding question: Has your system been developed using military planning, rehearsal, and execution doctrine? If so, what references did you use?
11. If yes to question 9: How are these mission planning, mission rehearsal, and mission monitoring/execution tasks incorporated in your system?
12. Are Course of Action Analysis and other front end analysis tasks included in "mission planning" for your effort?
13. What existing or new technologies or specific software will support the mission planning, mission rehearsal, and mission monitoring/execution tasks in your program?
14. If you listed items from question 13: How are you incorporating these new technologies or specific software packages that will support these planning, rehearsal, and execution tasks?
15. How do you plan to use new or evolving technologies in your program in the future?
16. How does your system operate with other simulations, training tools, and planning tools?
17. Does your program incorporate or use simulations for mission rehearsal tasks? Which simulations?

18. If yes to question previous question: How does your program incorporate or use simulations for mission rehearsal tasks?

19. If yes to question 17: Are these simulations integrated into your system?

20. If yes to previous question: How are these simulations integrated into your system?

21. Do you use fielded C2I systems and/or communications systems? Which ones?

22. If yes to previous question: What are the interfaces to fielded C2I and communications systems? Do you rely on messaging or are there database transfers?

23. How closely is the system tied to real C2I operations? For example: Can it access current real world data for planning? Can it be used to monitor the execution of an existing mission while simultaneously planning for the future?

24. What is the primary echelon(s) covered by this system? Is the system designed to cover additional echelons or has its use been extrapolated to other echelons?

25. Does your system focus on the strategic, operational, or tactical levels of war?

26. Is your system capable of supporting missions focused on Military Operations Other Than War (MOOTW)?

27. Does the program focus on workstation operators, command staff, or both?

28. What types of training are supplied/or planned to be supplied with the system? Who is the target audience?

29. Do evaluation processes run at real time? Faster than real time?

30. What are the requirements for evaluation processes to run faster than real time? Are these requirements documented?

31. How easily can your system be deployed and how much support equipment is required to assist in the deployment?

32. What is the basic equipment list to deploy all or part of your system?

33. How many support and operational staff does your system require for full operation and deployed operation?

34. How much training is typically required for the support and operational staff for full operation and deployed operation?

35. What is the typical range of planning cycle times supported by your system?

36. How quickly can a realistic scenario/rehearsal be created?

37. How many people are required to create a scenario or rehearsal?

38. What military customer organizations (users) have been involved in the development and testing of this system?

39. Is your system currently used, or will it be used, in single Service, Joint or international military exercises?

40. If yes to previous question: Are there reports analyzing your system's use in single Service, Joint, or international military exercises? Where could we get these reports?

41. Could we collect material describing the system design and operation? Is there a system overview document? Is there documentation describing (1) the system's relationship with fielded C2I and communications systems and/or (2) the system's capability to draw from real-world C2I information?

42. Where is this material available? On the web? In the program office? One of the Services?

43. What are you considering incorporating in planned product improvements? Are there follow-on efforts to the current program schedule?

44. If yes to question 47: Are there detailed planned product improvements? Where can we find these details?

45. What needs or requirements have you discovered that are not covered by the current system or planned improvements?

46. Are there new or evolving technologies that could be used in your program or EMPiRE?

47. Would your program be interested in working with this DARPA research effort? Are there documented or undocumented requirements relevant to EMPiRE that we should be studying?

48. Can you think of other programs related to our mission planning, mission rehearsal, and mission execution research? What are they? With whom should we talk about these systems?

49. If we have follow-on questions, could we contact you or someone else in your organization? If so, how (phone? email?)?

Military Processes and Practices Questions

(If the interviewee is knowledgeable concerning specific systems of interest to EMPiRE, fielded or under development, it may be worthwhile to ask some of the appropriate General Program Questions with regard to those systems.)

1. What doctrine does your organization use for planning, rehearsal, and execution processes? Where or how can we get copies of this doctrine?

2. What tools are used to assist the processes? Automated or manual?

3. Are requirements to automate these processes documented? Where?

4. Do the documented requirements capture all your perceived needs?

5. How well do the current tools work?

6. What tasks/echelons are covered by the current tools?

7. Are the current automated tools integrated into fielded C2I systems? How is this integration accomplished?

8. Which tools are used during all phases? Which tools are not used in all phases and why?

9. Is your organization working with any development or research program to enhance these processes or tools? Who?

10. Are other programs in place to improve these processes with new technologies? Where and which ones?

11. Are simulations used in the processes? Which ones?

12. If yes to previous question: Do these simulations derive input from, or provide output via, fielded C2I systems?

13. What are the typical planning, rehearsal, and execution time frames for your tasks in the following environments: home station, deployed but not fighting, deployed and fighting?

14. To what extent does the availability or use of tools vary across these environments? Which tools are not used in all environments, and why?

15. If you could improve some areas or processes by creating enhanced tools or technologies, what would they be? How would you like them to be improved?

16. Are you aware of current technologies that could assist your processes that are not being used to date?

17. Would you like additional opportunities to work with DARPA to enhance your processes?

18. If we have follow-on questions, could we contact you or someone else in your organization? If so, how (phone? email?)?

Study and Analysis Questions

(If answers to these questions indicate that one or more specific systems/programs were dealt with in detail, it may be worthwhile to ask some of the appropriate General Program Questions with regard to those systems/programs.)

1. Who sponsored this study/effort?

2. What military customer organizations (users) have been involved with this study/effort?

3. When will this study/effort be complete? Are there intermediate results?

4. Are there follow-on efforts to the current study/effort schedule?

5. How can EMPiRE obtain and use materials from this effort?

6. Where is this material available? On the web? In the program office? One of the Services?

7. Does your study relate to EMPiRE as we have described it?

8. What systems or military efforts are included in your study?

9. How does your study relate to mission planning, rehearsal, and execution activities? Is it associated with any specific initiatives in these areas? If so, are these Joint initiatives?

10. Did your effort focus on a particular echelon(s)?

11. What new technologies or systems are identified in your study/effort?

12. Did your study/effort uncover any requirements that are not currently being met?

13. Does your study/effort look into systems or programs that plan to meet these requirements?

14. What information about the use of simulations for mission rehearsal tasks is included?

15. What are the interfaces between simulation/planning tools and C2I systems that are identified? Are these interfaces to currently fielded C2I systems?

16. How does the study/effort focus on workstation operators, command staff, or both?

17. Does your study/effort detail how simulations, training tools, and planning tools should operate together?

18. Does your study/effort describe how much training is required for the support and operational staff for full operation and deployed operation of various C2I systems?

19. IF this is a continuing effort: Would your study/effort be interested in working with this DARPA research effort?

20. Are there documented or undocumented requirements relevant to EMPiRE that we should be studying?

21. If we have follow-on questions, could we contact you or someone else in your organization? If so, how (phone? email?)?

APPENDIX E - UNIFIED COMMANDS WITH REGIONAL RESPONSIBILITIES

This appendix, which includes information primarily derived from various Joint and Service websites, constitutes a snapshot of regional Unified Command organizations and activities as of July-October 1998. This information is not readily available from any central unclassified source, and several of the websites consulted are no longer openly accessible.

This information was gathered primarily to provide and indication of the various types of deployments, actual operations, and exercises, both Joint and international, in which U.S. forces are currently involved.

U.S. ATLANTIC COMMAND (USACOM) -- NORFOLK VA

Area of Responsibility—Most of the Atlantic Ocean and islands therein (except UK and Ireland). This AOR has been reduced in recent years by the assignment of the Gulf of Mexico, Caribbean, and waters adjacent to Central and South America to USSOUTHCOM.

Prior to its 1993 reconfiguration, USACOM was a predominantly maritime command, always commanded by a Navy Admiral (who until recent years was also CINCLANTFLT).

CINCUSACOM is also NATO's Supreme Allied Commander Atlantic (SACLANT). Major military operations in the USACOM AOR would likely take place in a NATO context.

The 1993 revision of the Unified Command Plan gave USACOM responsibility as the primary "Joint Task Force Trainer, Integrator, and Provider." Its component commands embody almost all CONUS-based forces; the USACOM responsibility is to ensure that these forces are combat-ready and trained to operate as part of a Joint Task Force. These forces are viewed as assets that may be provided to any of the warfighting CINCs as circumstances dictate.

USACOM service component commands are:

- Navy: U.S. Atlantic Fleet, with U.S. SECOND Fleet as the primary operational command. (Both are in Norfolk.)
- Marines: Marine Corps Forces Atlantic. The commander is CG II MEF, who (as CG FMFLANT) reports administratively to CINCLANTFLT.
- Army: U.S. Army Forces Command (Ft. McPherson GA), including I Corps, III Corps, and XVIII Airborne Corps.
- Air Force: Air Combat Command (Langley AFB VA), including 1st, 8th, 9th, and 12th Air Forces.

USACOM sub-unified commands are:

- Special Operations Command Atlantic
- Iceland Defense Force (NAS Keflavik), commanded by a Navy Rear Admiral who is also NATO's Island Commander Iceland
- U.S. Forces Azores (Lajes Field), commanded by an Air Force Colonel

USACOM has a standing Joint Task Force, JTF-6 at Fort Bliss, Texas, which reports to Forces Command. JTF-6 "synchronizes and integrates DoD operational, technological, training, and intelligence support to drug law enforcement agency counter-drug efforts in CONUS."

USACOM uses JCS-defined categories to describe training, including:

- Category I - Service-mandated training, focused on achieving proficiency in service tactics, techniques, and procedures. Includes individual training in service schools.
- Category II - Joint field training at tactical and operational levels. "USACOM coordinates training opportunities and provides specific Joint mission-essential tasks for incorporation into unit training. The Services are brought together in the field to practice their skills in a Joint environment. (The largest Atlantic Command Joint live exercise series, Ocean Venture and Solid Shield, are no longer held.)
- Category III - The United Endeavor series of exercises "to provide training for Joint force commanders, their staffs, and their components, focusing on the operational and strategic levels."

REMARKS:

Joint training is really USACOM's primary task today, given that real-world military contingencies in its AOR are highly unlikely. Its sub-unified commands in Iceland and the Azores are primarily concerned with small-scale continuing operations. JTF-6 is a special case, which is not to say that it couldn't make good use of a simulation capability to support its planning and allocation of resources.

The United Endeavor exercises appear to focus on large scenarios involving a high-level command as the CJTF. Each such command only gets its turn to play every few years, and then only with respect to a scenario in one of the several theaters to which it might deploy.

For smaller contingencies, CJTF responsibilities could conceivably be assigned to a lower level staff. Some such staffs may receive training in connection with live Joint exercises, but such training opportunities are apparently no longer common. Given that scenarios would be simpler/smaller, an embedded simulation capability might be useful at these lower levels.

U.S. SOUTHERN COMMAND (USSOUTHCOM) -- MIAMI FL

Area of Responsibility -- Central and South America, less Mexico, with adjacent Atlantic/Pacific waters, the Gulf of Mexico, the Caribbean Sea, and the islands therein.

USSOUTHCOM was established in 1963, succeeding the Caribbean Command which historically focused on defense of the Panama Canal.

USSOUTHCOM's current strategy emphasizes:

- Building regional cooperative security through confidence-building measures and reducing tensions.
- Developing military roles and missions -- encouraging regional militaries to develop appropriate force structures, respect civilian authority, and uphold human rights.

- Supporting the national counter-drug strategy, by cooperating with U.S. counter-drug agencies and by providing "training and operational support, equipment, technological advances, and maintenance support" to those agencies and to the counter-drug organizations of other nations in the region.

USSOUTHCOM Service component commands are:

- Navy: U.S. Atlantic Fleet, with forward-based CINCLANTFLT Detachment South at Rodman Naval Station, Panama.
- Marines: Marine Corps Forces South, basically a planning cell at Fleet Marine Force Atlantic headquarters in Norfolk.
- Army: U.S. Army South, Fort Clayton, Panama.
- Air Force: U.S. Southern Air Forces, Davis-Monthan AFB AZ, with forward based 24th Wing at Howard AFB, Panama. Commander is also commander of 12th Air Force.

The only USSOUTHCOM sub-unified command is Special Operations Command South (SOCSOUTH) at Corozal, Panama.

There are three standing Joint Task Forces in SOUTHCOM:

- JTF Bravo, at Soto Cano Air Base, Honduras, was originally established to "deter Nicaraguan aggression" during the Sandinista era. Its mission today is to "conduct and support Joint, Combined, and interagency cooperation ... to enhance regional security." With about 400 personnel, mostly Army, it primarily supports training deployments.
- Joint Interagency Task Force East, at NAS Key West, Florida, includes Coast Guard and Customs Service as well as DoD personnel. It maintains a "Joint Operations Command Center" for the purpose of monitoring air and surface traffic in connection with the nation's counter-drug strategy.
- Joint Interagency Task Force South, at Howard AFB, Panama, integrates DoD, DEA, Customs Service, and "Participating Nation counter-drug forces" in efforts to make narcotics trafficking more costly and difficult. Its roles include the detection and monitoring of suspect vessels and aircraft, the development of counter-drug intelligence, and the provision of training, logistics, planning assistance, and communications support for counter-drug efforts in Panama and South America.

USSOUTHCOM exercises during FY 1998 included the following:

- Cabanas 98—Held at Camp Santiago, PR, and run by SOCSOUTH, this exercise focused on specified UN peacekeeping tasks and involved a "Coalition Battalion Staff" with representatives from Argentina, Bolivia, Chile, Uruguay, and Paraguay.
- Tradewind 98—Conducted by U.S. Army South and the "Regional Security System Caribbean Region," this exercise sought to "improve the ability of RSS and other participating CARICOM forces to respond to anticipated national disasters and security emergencies." Ground portions were conducted in Belize and maritime portions in Belize, Antigua, and Trinidad.
- FU PKO SOUTHAM 98—Sponsored by USSOUTHCOM but hosted by Paraguay, this was a brigade-level CPX focusing on peacekeeping operations with "human rights observance." Other participating nations were Argentina, Bolivia, Brazil, Chile, Uruguay, and Venezuela.
- FU PKO 98 CENTAM—Similar to the equivalent South American exercise above, but hosted by Guatemala and involving Central American and Caribbean participants.

- FA Humanitarian 98—A CPX focused on disaster relief and involving Central American and Caribbean nations.
- Blue Advance 98—A USSOUTHCOM national exercise, Blue Advance 98 focused on disaster relief in U.S. Caribbean territories. Players included SOUTHCOM headquarters, component command headquarters, a JTF, FEMA, DOT, USACOM, and USTRANSCOM.
- UNITAS 34-98—Held during July-November, this was the 1998 iteration of an annual multinational naval exercise involving a transit around South America, during which various training exercises are held with regional navies. The U.S. participants included COMDESRON 32, a DD, an FFG, and LST, an SSN, and a Coast Guard Cutter, plus USMC, Patrol Squadron (P-3C), and SPECWAR elements.
- Fuertes Defensas 98/99—This was the Unified Endeavor exercise discussed in the JTASC interview report.

REMARKS:

USSOUTHCOM has few assigned forces. The live exercises conducted are multinational, primarily focused on operations other than war, and are small in scale, if only because the participating nations do not have large assets to commit. The tempo of counterdrug operations is probably quite high, with significant resources committed; there could be a role for simulation in evaluating the most effective way to employ assets as the nature of the problem changes. There is a history of recent Joint military operations in the region -- the Grenada operation in the early '80s (when the Caribbean was a USCINCLANT responsibility) and the later Panama intervention.

U.S. CENTRAL COMMAND—MACDILL AFB, TAMPA FL

Area of Responsibility—Egypt and Southwest Asia eastward through Pakistan (excluding Lebanon, Syria, and Israel, in the USEUCOM AOR); Sudan and other African nations bordering the Indian Ocean southward through Kenya; the Red Sea, Arabian Gulf, and Indian Ocean areas bordering the land AOR; Asian nations formerly part of the Soviet Union (effective October 1999).

USCENTCOM was established in 1983, succeeding the existing Rapid Deployment Joint Task Force.

USCENTCOM Service component commands are described below:

- Army: USARCENT, with headquarters at Fort McPherson, Georgia, is also U.S. Third Army. Third Army has no dedicated forces of its own. It maintains a forward-based ARCENT Kuwait at Camp Doha, commanded by a Colonel, whose task is to maintain a Heavy Brigade equipment set; plan, direct, and support exercises with the Kuwaiti armed forces, and maintain contingency plans for the defense of Kuwait.
- Air Force: USCENTAF, with headquarters at Shaw AFB, South Carolina, is also Ninth Air Force.
- Navy: USNAVCENT, with headquarters at Manama, Bahrain, is also U.S. FIFTH Fleet. Most forces, such as Carrier Battle Groups and Amphibious Ready Groups, are rotationally deployed from the Atlantic and Pacific Fleets, but a small permanent surface combatant force, Task Force 50, and a supporting logistics task force are stationed permanently in the region.
- Marines: USMARCENT is a liaison cell at Fleet Marine Force Pacific headquarters at Camp H.M. Smith, Hawaii.

USSOCCENT is a sub-unified command for Special Operations with its headquarters within USCENTCOM headquarters at MacDill AFB. It maintains a forward presence through Naval Special Warfare Unit Three in Bahrain; in addition, Army Special Forces vehicles and equipment and Navy SEAL Desert Patrol Vehicles are pre-positioned in Kuwait and Bahrain respectively.

Joint Task Force Southwest Asia (JTF-SWA), located at Eskan Village, Saudi Arabia, is responsible for Operation Southern Watch, enforcing the southern no-fly zone over Iraq. For this purpose, JTF-SWA includes British, French, and Saudi as well as U.S. (Air Force/Navy) forces.

USCENTCOM operations and exercises in recent years have included:

- Continuing maritime interception operations in the Arabian Gulf, conducted with coalition forces and aimed at attempts to illegally export Iraqi oil and dates and smuggle in prohibited cargo, mostly via small inshore vessels.
- Operation Desert Strike, involving coordinated cruise missile strikes on SAM sites and C2 nodes in southern Iraq; associated with the operation were deployments of Air Force fighter squadrons, an Army Heavy Brigade Task Force, and a second Carrier Battle Group.
- Exercise Rugged Nautilus, a national short-notice exercise which involved establishing a JTF under Deputy Commander NAVCENT, designating the deployed Carrier Battle Group commander as Joint Force Maritime Component Commander (JFMCC), and deploying a second Battle Group staff to function on the carrier as a JFACC.
- Various Special Forces activities including humanitarian demining operations in Eritrea and Ethiopia, assistance with counterdrug efforts in Pakistan, and the IRIS GOLD series of internal defense exercises with host nations.

REMARKS:

Under normal circumstances, USCENTCOM has relatively few forces located within its AOR, but it must plan to counter fairly formidable threats. The Desert Shield force deployment evolution was characterized by a need for frequent re-planning. Plans had to be formulated and in place to counter an immediate threat with the forces available, but as more forces continually arrived (with additional capabilities) planners naturally needed to adapt their plans to take advantage of them. This command would likely be an enthusiastic supporter of better mission planning tools, including those optimized to support deployed forces.

U.S. PACIFIC COMMAND -- CAMP H. M. SMITH, HI

Area of Responsibility:

- Pacific and Indian Oceans, except waters adjacent to Central and South America (USSOUTHCOM AOR) and those Indian Ocean waters in the USCENTCOM AOR Alaska.
- Mongolia, China, India, and remainder of Asia to the east and south.
- All Pacific and Indian Ocean island nations including Madagascar.

USPACOM Service component commands are:

- Navy: U.S. Pacific Fleet, with headquarters near Pearl Harbor, Hawaii. Its primary operational forces are THIRD Fleet (flagship home-ported in San Diego) and SEVENTH Fleet (flagship homeported in Yokosuka, Japan). SEVENTH Fleet is responsible for operations west of Hawaii,

using 16 ships home-ported in Japan as well as rotating deployers from other areas. THIRD Fleet conducts operations in the eastern Pacific, including training of forces prior to deployments to the western Pacific or Indian Ocean; its commander can also function as a contingency JTF commander if required.

- Marines: Marine Forces Pacific (MARFORPAC), consisting of I MEF (First Marine Expeditionary Force), based in southern California and Arizona, and III MEF based in Okinawa and Hawaii. Each MEF embodies a Marine Division and a Marine Air Wing, plus a Service Support Group and command element. The commander of MARFORPAC is also Commanding General, Fleet Marine Force Pacific under CINCPACFLT. He is also the Marine component commander for USCINCCENT and U.S. Forces Korea, and would become a Combined Marine Forces Commander in the event of hostilities in Korea.
- Army: U.S. Army Pacific, with headquarters at Fort Shafter, Hawaii. Major combatant elements are the 25th Infantry Division (Light), split-based in Hawaii and Ft. Lewis, Washington, and the 1st Brigade, 6th Infantry Division (Light) based in Alaska.
- Air Force: U.S. Pacific Air Forces, with headquarters at Hickam AFB, Hawaii. Major forces are the Fifth, Seventh, Eleventh, and Thirteenth Air Forces based in Japan, Korea, Alaska, and Guam respectively. PACAF includes four fighter wings (in Alaska, Japan, and Korea (2)), multi-mission wings in Japan and Alaska, and an airlift wing in Japan.

USPACOM includes four subordinate unified commands as follows:

- Special Operations Command Pacific, with headquarters within USPACOM headquarters, maintains operational control of all Special Operations forces assigned to PACOM.
- U.S. Forces Japan, with headquarters at Yokota AB and 44,000 personnel, is responsible for the defense of Japan pursuant to the U.S.-Japan Treaty of Mutual Cooperation and Security.
- U.S. Forces Korea, with headquarters in Seoul, includes the Eighth U.S. Army. The commander, an Army General, is also CINCUNC (United Nations Command) and Commander in Chief, ROK/U.S Combined Forces Command.
- Alaskan Command, with headquarters at Elmendorf AFB in Anchorage, is commanded by an Air Force Lieutenant General who is also the commander of Eleventh Air Force.

USPACOM has three standing Joint Task Forces, of which one, Joint Task Force Full Accounting, is concerned with POW/MIA issues. The other two are:

- Joint Interagency Task Force West, at Coast Guard Island, Alameda, California, designated USCINCPAC's "executive agent for DoD support to national counterdrug initiatives." It provides intelligence concerning drugs originating is Asia, support to country teams in various host nations, and "intelligence-cued counterdrug detection and monitoring" in the eastern Pacific.
- Joint Task Force 510, a standing "crisis response, rapid deployment JTF" apparently built around elements of Special Operations Command Pacific. JTF 510 can "deploy in response to a crisis situation to provide ... an assessment, to recommend courses of action, and/or to conduct military operations," which could include humanitarian assistance, disaster relief, and noncombatant evacuation. Based on JTF 510's assessment of the situation, USCINCPAC may opt to create a larger JTF to manage the crisis, in which case JTF 510 "facilitates closure of this larger JTF and transitions into a Joint Special Operations Task Force (JSOTF) in support of the JTF commander."

USPACOM exercises include the following:

- The RIMPAC series of biennial multinational fleet exercises. RIMPAC 98 was a month-long exercise held off Hawaii and involving surface ships, submarines, and maritime patrol aircraft from the U.S., Australia, Japan, Chile, Canada, and Korea. A total of 52 ships participated, including a U.S. Carrier Battle Group and Marine Expeditionary Unit.
- The Cobra Gold series of Combined U.S-Thai exercises. Cobra Gold 98 was a two-week exercise including Joint/Combined air and land operations, Combined naval operations, and amphibious operations. The command element of III MEF performed as a JTF headquarters.
- The Ulchi Focus Lens series of command post exercises for the U.S./ROK Combined Forces Command
- Various bilateral air exercises involving PACAF units and, among other nations, Australia, Japan, Singapore, and Thailand .
- Numerous command post and field training exercises with regional armies, conducted from the platoon to division level.

REMARKS:

USPACOM is highly focused on conducting Combined operations under rather "informal" arrangements (as contrasted with a formal alliance structure like NATO). The major exception is Korea, where there is an established Combined command structure and a well-defined threat. The existence of an standing JTF for contingency operations could offer the opportunity for a staff experienced in planning to evaluate proposed tools.

U.S. EUROPEAN COMMAND -- STUTTGART, GERMANY

Area of Responsibility - Europe including Turkey, Ireland and the United Kingdom; Africa outside the USCENTCOM AOR; Israel, Lebanon, and Syria; the Mediterranean, Baltic, and Black Seas; and (effective October 1998) the European states of the former Soviet Union.

USCINCEUR is also NATO's Supreme Allied Commander Europe and as such maintains his headquarters at SHAPE in Mons, Belgium.

USEUCOM Service component commands are:

- U.S. Army Europe (USAREUR), the main element of which is V Corps, with headquarters in Heidelberg, Germany. Major elements of V Corps include the 1st Armored Division and 1st Infantry Division. The major element based outside Germany is the Southern European Task Force (SETAF) at Vicenza, Italy, described as an "airborne reaction force and JTF headquarters ready to respond anywhere within the EUCOM AOR." Task Force Eagle, in Bosnia, and Task Force Able Sentry, in Macedonia, are associated with peacekeeping efforts further discussed below.
- U.S. Air Forces in Europe (USAFE), with headquarters at Ramstein Air Base, Germany. USAFE comprises two numbered Air Forces, 3rd AF (RAF Mildenhall, UK) responsible for the area north of the Alps, and 16th AF (Aviano AB, Italy). Within 16th Air Force, the 16th Air Expeditionary Wing at Aviano provides support to NATO operations in Bosnia, and the 31st Air Expeditionary Wing at Incirlik AB, Turkey supports Operation Northern Watch, enforcing the no-fly zone over northern Iraq. The commander of 16th Air Force is also NATO's COMAIRSOUTH.

- U.S. Naval Forces Europe (USNAVEUR), with headquarters in London. The main USNAVEUR operational component is the SIXTH Fleet in the Mediterranean, which derives its assets primarily from deploying units of the U.S. Atlantic Fleet. CINCUSNAVEUR is also NATO's CINCSOUTH, maintaining his personal headquarters in Naples.

Special Operations Command Europe (SOCEUR), a sub-unified command, maintains operational control over all assigned or attached special operations forces in the EUCOM AOR.

The USEUCOM staff includes an Office of Analysis and Simulation (ECCS-AS) which acts as USCINCEUR's executive agent for the "Joint Modeling and Simulation" process and provides "near-term analytic support." Its role in the latter area is to "analyze, evaluate, and recommend modifications to force employment, deployment, and sustainment alternatives by means of operations research and computer science applications in support of current operations, Joint planning cells, contingency planners, deliberate planners, exercise planners, and exercise participants." Specific services include scenario development, COA analysis support for USEUCOM, component, and JTF staffs, and comparative analyses of deployment and sustainment options. This office participates in various working groups associated with developing new capabilities and also develops "custom-made tools to support decision makers." It was responsible for developing and deploying a "Distributive Collaborative Planning" capability for "deployed C2 nodes" based on "fielding a wide bandwidth, secure tactical internet through commercial business satellite transponders."

Examples of recent or continuing operations in EUCOM include:

- Operation Shepherd Venture, which involved deployment of elements of SOCEUR, including the "command support elements of a forward JTF", to Dakar, Senegal in anticipation of a requirement to evacuate U.S. citizens from neighboring Guinea-Bissau.
- Operation Joint Forge, which provides the U.S. contribution to the NATO-led Stabilization Force (SFOR) in Bosnia. The Commanding General of USAREUR and 7th Army is the commander of both Joint Forge ("Task Force Eagle" and SFOR. The U.S. component of some 6900 personnel, primarily in northeast Bosnia, provides the headquarters and majority of the troops for one of the three multinational divisions of SFOR. The major force commitments have rotated among the two divisions of 7th Army in Germany and the CONUS-based 2nd Armored Cavalry Regiment.
- Operation Deliberate Forge, the NATO air operation in support of the SFOR in Bosnia. The operation is commanded by NATO's COMAIRSOUTH (USAFE's Commander 16th Air Force). Assets committed include 16th Air Force F-16s, KC-135 tankers, Navy/Marine EA-6B EW aircraft, and various Special Operations airplanes and helicopters.
- Humanitarian de-mining operations in Bosnia, Lebanon, and several African nations.

Exercises involving USEUCOM during 1998 included the following:

- Exercise Agile Lion, a two-week exercise at the Grafenwoehr Training Area in Germany, allowed the Southern European Task Force staff to plan, rehearse, and execute operations related to forming, organizing, deploying, and operating a Joint Task Force. Participants included elements of the USEUCOM staff; Army, Navy, and Air Force units in Europe; and elements of the U.S. Special Operations Command.
- Exercise Reliant Mermaid, a Search and Rescue exercise involving Israeli, Turkish, and U.S. naval ships and aircraft.
- Exercise French Afrique, held in Senegal and involving forces of eight West African nations, the U.S., the United Kingdom, and France. The exercise objective was to show the ability of the

African state to "participate in their own security with the logistical assistance of supporting nations."

- Operation Strong Resolve 98, a major NATO live exercise involving SACLANT and SACEUR and designed to test NATO's capability to cope with simultaneous crises in two regions. The scenario involved a "territorial defense exercise" in northern Norway and a peacekeeping exercise in NATO's Iberian Atlantic area; participants in the latter included ten "Partnership for Peace (PfP) nations as well as NATO members.
- Dynamic Response 98, an exercise testing the ability of the NATO Stabilization Force Strategic Reserve to deploy to Bosnia via Croatia. Participating nations were the U.S., Turkey, Italy, the Netherlands, Poland, and Romania. The primary U.S. force involved was the 26th Marine Expeditionary Unit and its amphibious shipping.
- Combined Endeavor 98, a C4 interoperability exercise sponsored by USEUCOM and the German Ministry of Defense and involving a total of 28 NATO and Partnership for Peace nations.
- BALTOPS 98, an annual U.S. national exercise sponsored by CINCUSNAVEUR. Participants included one cruiser, with Commander Carrier Group Eight on board as exercise commander, one frigate, one Coast Guard cutter, and P-3C and F-16 aircraft. The exercise included operations with both NATO and PfP nations.
- Baltic Challenge 98, an 11-nation exercise held in and near Klaipeda, Lithuania with the objective of developing a "common understanding of peacekeeping operations." Most U.S. participants were Reserve and National Guard personnel.
- Cooperative Assembly, a NATO-sponsored Partnership for Peace exercise in Albania involving forces of fourteen nations and emphasizing "infantry peacekeeping skills" but also including CAS, SAR, and MedEvac operations. U.S. participants included a Marine Expeditionary Unit contingent of about 250 personnel.
- Cooperative Best Effort, a similar exercise held in FYR Macedonia and involving units from 28 nations.

REMARKS:

The primary mission of USEUCOM continues to be the provision of combat-ready forces to NATO. The focus of attention, however, has changed from preparing for a massive military conflict to addressing a more complex and fluid situation where multiple simultaneous contingencies are more likely to arise. The forces assigned to USEUCOM are significantly smaller than in the past, and the opportunity to conduct large national and NATO live exercises with those forces has diminished even more. Current exercises, though numerous, seem for the most part to be quite small, involving in many cases only platoon-sized units and emphasizing peacekeeping, nation building, and other nontraditional objectives. These exercises appear to be primarily oriented toward enhancing relationships with other regional militaries, with far less emphasis on maintaining the warfighting skills of U.S. forces. USEUCOM would likely benefit from improved capabilities for rapid contingency planning as well as enhanced support for training.

APPENDIX F - TABLE OF APPLICABLE TOOLS AND TECHNOLOGIES

The following table summarizes tools and technologies which were discussed during interviews and which were identified as possibly relevant to the stated goals of EMPiRE:

Interview	Item	Remarks
Armed Forces Staff College	JRAMS	Joint level planning application to access and display information on availability and readiness of forces; uses GCCS data files (GSORTS, TPFDDs).
Armed Forces Staff College	Satellite Tool Kit	Commercial software supporting planning for satellite surveillance or counter-surveillance
Armed Forces Staff College	Spectrum	Stand-alone simulation allowing consideration of economic, political, and social factors impacting military decision making.
COAA	"Constraint Satisfaction"	Technical approach used in COAA proof of principle system. Recommended for COA development/analysis under realistic time constraints. Previously used for CFOR.
COAA	"Task Decomposition"	Technical approach for an "Adversarial Planner" as briefed to Army Model and Simulation Office; may have potential as a "worst-case" enemy COA generator.
COAA	Battlefield Planning and Visualization (BPV)	Concept demonstrator incorporating some battle planning tools on top of Virtual Graphics Information System. BPV capability is (per interview) intended for MCS Block IV.
COAA	COAA Proof of Principle System	Windows NT application for COA development and analysis, interfacing with MCS and BPV. Includes editor and analysis/feedback capabilities
JMCIS	Battle Force Tactical Training	Single or multi-ship team training capability involving realistic, scenario-driven stimulation of multiple sensors.
JSIMS	Joint Conflict and Tactical Simulation (JCATS)	JTF-level simulation for analysis and mission rehearsal; marriage of Joint Tactical Simulation and Joint Conflict Model, with 3D capability but no dedicated C4I system interface
JSIMS	Simulation Information Filtering Tool (SIFT) and Intelligent Simulation Reporting Agent (ISRA)	Tools used with Janus simulation to obtain specified information reports during simulation.
JSIMS	Swarm	Application for multiagent simulation of complex systems; used in COREBA and in West Point COA tool research.

Interview	Item	Remarks
JTASC	Adaptive Course of Action (ACOA) ACTD	Follow-on to AJP ACTD
JTASC	Advanced Joint Planning (AJP) ACTD	Completed ACTD providing improved tools for GCCS, primarily related to access and visualization of force readiness and status from multiple databases.
JTASC	Common Operational Modeling, Planning, and Simulation Strategy (COMPASS)	Prototype "middleware" facilitating collaborative planning, with simulation support, at multiple levels including tactical.
JTASC	Joint Theater Level System (JTLS)	Operational level simulation used primarily for OPLAN development and analysis.
JTASC	Joint Training Confederation (JTC)	Set of Service and other ALSP linked simulations used to support JTF level exercises; 1998 JTC defines baseline capabilities for JSIMS IOC.
MITRE OPORD Study	JCOS (Joint Countermine Operational Simulation) AARS (After Action Reporting System)	AARS developed by MITRE, described as using Web-based tools and cited by Annette Janeway as using agent-based technology. Is government-owned software.
MITRE OPORD Study	SEDRIS (Synthetic Environment Data Representation and Interchange Specification)	Data model, Application Program Interface, and standalone software tools; supports both image generation and synthetic forces interaction with environment.
USACOM J-9	DARPA JFACC program	Ongoing, multiyear project to introduce new planning and execution processes supported by objective-based planning and common plan representation.
WARSIM	Cognition Oriented Emergent Behavior Architecture (COREBA)	Lockheed Martin Technology for behavior and decision making algorithms.
WARSIM	Dynamic Virtual World/ Dynamic Terrain Objects	DARPA Synthetic Theater of War developments for environments and terrains

APPENDIX G - ACRONYM LIST

AADC	Anti Aircraft Defense Commander
AAR	After Action Review
AARS	After Action Reporting System
ABCS	Army Battlefield Command System
ABIS	Advanced Battlespace Information System
ACDB	Army Battlefield Command System Common Database
ACOA	Adaptive Course of Action
ACOS	Assistant Chief of Staff
ACTD	Advanced Concept Technology Demonstration
ADST II	Advanced Distributed Simulation Technology II
ADVON	Advanced Echelon
AFATDS	Advanced Field Artillery Tactical Data System
AFB	Air Force Base
AFMSS	Air Force Mission Support System
AFSC	Armed Forces Staff College
AMDWS	Army Missile Defense Work Station
AOR	Area of Responsibility
ARL-UT	Applied Research Laboratory - University of Texas
ASAS	All Source Analysis System
ASC	Advanced Simulation Center
ASTT	Advanced Simulation Technology Thrust
ATCCS	Army Tactical Command and Control System
ATD	Advanced Technology Demonstration
ATO	Air Tasking Order
AWSIM	Air Force Warfare Simulation
BADD	Battlefield Awareness and Data Dissemination
BFA	Battlefield Functional Area
BFTT	Battle Force Tactical Training
BOS	Battlefield Operating Systems
BPV	Battlefield Planning and Visualization

BSC	Brigade/Battalion Battle Simulation Center
BSE	Battle Space Entity
C2	Command and Control
C2I	Command, Control and Intelligence
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CBT	Computer Based Training
CCIR	Commander's Critical Information Requirements
CCTT	Close Combat Tactical Trainer
CECOM	U.S. Army Communications and Electronics Command
CFOR	Command Forces
CGF	Computer Generated Forces
CHS	Common Hardware Software
CINC	Commander in Chief
CJCS	Chairman of the Joint Chiefs of Staff
CJCSM	Chairman of the Joint Chief of Staff Memorandum
CJTF	Commander, Joint Task Force
CMP	Common Message Processor
COA	Course of Action
COAA	Course of Action Analysis
COAST	Course of Action Selection Tool
COMSEC	Communications Security
CONOPS	Concept of Operations
CONPLAN	Operation Plan in Concept Format
COP	Common Operational Picture
COREBA	Cognition Oriented Emergent Behavior Architecture
CoS	Chief of Staff
CPIM	Command Post Interface Module
CPoF	Command Post of the Future
CRITIC	Critical Intelligence Report
CSL	Conflict Simulation Laboratory
CSS	Combat Support System
CSSCS	Combat Service Support Control System

CSSTS	Combat Service Support Training Simulation
CTAPS	Contingency Theater Automated Planning System
CTDB	Compact Terrain Database
CTSF	Central Technical Support Facility
CY	Calendar Year
DARPA	Defense Advanced Research Projects Agency
DART	Dynamic Analysis and Re-planning Tool
DIA	Defense Investigative Agency
DII-COE	Defense Information Infrastructure - Common Operating Environment
DIS	Distributed Interactive Simulation
DISA	Defense Information Systems Agency
DJTI	Distributed Joint Training Initiative
DLA	Defense Logistics Agency
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
DoS	Department of State
DSCS	Defense Satellite Communications System
EA	Executive Agent
EAC	Echelon Above Corps
EADSIM	Extended Air Defense Simulation
EMPiRE	Embedded Mission Planning and Rehearsal
ESC	U.S. Air Force Electronics System Center
EVAC	Evacuation System
FAADC2I	Forward Area Air Defense Command, Control, and Intelligence System
FAPES	Force Augmentation Planning and Execution System
FBCB2	Force XXI Battle Command - Brigade and Below
FDD	First Digitized Division
FOC	Final Operational Capability
FOTC	Force Over the Horizon Track Coordinator
FY	Fiscal Year
GCCS	Global Command and Control System
GCCS-A	Global Command and Control System -- Army
GCCS-M	Global Command and Control System -- Maritime

GMF	Ground Mobile Facility
GRIS	Global Reconnaissance Information System
GSORTS	Global Status of Resources and Training
GTN	Global Transportation Network
HLA	High Level Architecture
IAW	In Accordance With
IMRAS	Individual Manpower Requirements and Availability System
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
IPB	Intelligence Preparation of the Battlefield
IPT	Integrated Product Team
IRAD	Internal Research and Development
ISP	Integrated System Prototype
ISR	Intelligence Surveillance and Reconnaissance
ISRA	Intelligent Simulation Reporting Agent
JAMIP	Joint Analytical Model Improvement Program
JBC	Joint Battle Center
JCATS	Joint Conflict and Tactical Simulation
JCEOI	Joint Communications Electronics Operations Instructions
JCM	Joint Conflict Model
JCMMS	Joint Conceptual Model of the Mission Space
JCOS	Joint Counter-mine Operational Simulation
JCS	Joint Chief of Staff
JCSOS	Joint Combined Staff Officer School
JCWS	Joint and Combined Warfighting School
JDISS	Joint Deployable Intelligence Support System
JEPES	Joint Engineering and Planning Execution System
JFACC	Joint Forces Air Component Commander
JFAST	Joint Feasibility Analysis System for Transportation
JFLCC	Joint Forces Land Component Commander
JFMCC	Joint Forces Maritime Component Commander
JFSOCC	Joint Forces Special Operations Component Commander
JIC	Joint Intelligence Center

JMCIS	Joint Maritime Command Information System
JMSRP	Joint Modeling and Simulation Resource Repository
JMTK	Joint Mapping Tool Kit
JointSAF	Joint Semi-Automated Forces Simulation
JOPES	Joint Operation Planning and Execution System
JOTS	Joint Operations Tactical System
JPEC	Joint Planning and Execution Community
JPOC	Joint Planning Orientation Course
JRAMS	Joint Readiness Automated Management System
JRCC	Joint Rescue Coordination Center
JSCP	Joint Strategic Capabilities Plan
JSIMS	Joint Simulation System
JTA	Joint Technical Architecture
JTASC	Joint Training Analysis and Simulation Center
JTC	Joint Training Confederation
JTF	Joint Task Force
JTLS	Joint Theater Level Simulation
JTS	Joint Tactical Simulation
JV2010	Joint Vision 2010
JWARS	Joint Warfare Simulation
JWFC	Joint War Fighting Center
JWID	Joint Warfighter Interoperability Demonstration
LCC	Land Component Commander
LMC	Lockheed Martin Corporation
LMIS	Lockheed Martin Information Systems
LOC	Line of Communication
LOGSAFE	Logistics Sustainability and Feasibility Estimator
LRC	Lesser Regional Contingency
LUT	Limited User Test
M&S	Modeling and Simulation
MAGTF	Marine Air - Ground Task Force
MCCIS	Maritime Command and Control Information System
MCS	Maneuver Control System

MDMP	Military Decision Making Process
MEF	Marine Expeditionary Force
MEPES	Medical Planning and Execution System
METT-T	Mission, Enemy, Troops, Terrain, and Time Available
MEU	Marine Expeditionary Unit
MFA	Maneuver Functional Area
MILSATCOM	Military Satellite Communications System
MoM	Model of the Mission Space
MOOTW	Military Operations Other Than War
MRC	Major Regional Contingency
MSE	Mobile Subscriber Equipment
MSO	Mission Space Object
MTWS	MAGTF Tactical Warfare System
NBC	Nuclear, Biological, and Chemical
NCA	National Command Authority
NEO	Non-combatant Evacuation Operations
NMCC	National Military Command Center
NSA	National Security Agency
OPCON	Operational Control
OPLAN	Operation Plan
OPORD	Operation Order
OPS	Operations
OPSEC	Operations Security
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OTH-T	Over the Horizon Targeting
PID	Plan Identification Number
POC	Point of Contact
PSM	Portable Space Model
PSYOP	Psychological Operations
RDA	Requirements Development and Analysis System
RESA	Research Evaluation and System Analysis Simulation
RSSC	Regional Space Support Center

RTC	Regional Training Center
SAMS	School of Advanced Military Studies
SECDEF	Secretary of Defense
SEDRIS	Synthetic Environment Data Representation Interchange Specification
SIGINT	Signals Intelligence
SISO	Simulation Interoperability Standards Organization
SITREP	Situation Report
SIW	SISO Simulation Interoperability Workshop
SME	Subject Matter Expert
SMI	Soldier Machine Interface
SOC	Special Operations Center
SOF	Special Operations Forces
SOTA	SIGINT Operational Tasking Authority
SSDD	System Segment Design Document
STRICOM	US Army Simulation Training and Instrumentation Command
TACSIM	Tactical Simulation
TAMPS	Tactical Automated Mission Planning System (Originally (?) Tactical Aircraft Mission Planning System)
TARGET	Theater Analysis and Re-planning Graphical Execution Toolkit
TBMCS	Theater Battle Management Core System
TENCAP	Tactical Exploitation of National Capabilities Program
TERS	Tactical Event Reporting System
TO&E	Table of Organization and Equipment
TOC	Tactical Operations Center
TOE	Table of Organization and Equipment
TPFDD	Time Phased Force Deployment Data
TPFDL	Time Phased Force Deployment List
TRADOC	US Army Training and Doctrine Command
UCCATS	Urban Combat Computer Assisted Training System
UE	United Endeavor
URL	Universal Resource Locator
USACOM	US Atlantic Command
USAF	United States Air Force
USMTF	United States Message Text Format

USPACOM	US Pacific Command
USSOCOM	US Special Operations Command
USSPACECOM	US Space Command
USTRANSCOM	US Transportation Command
UTO	Unit Task Organization
WARSIM	Warfighter's Simulation 2000
WFX	Warfighter Exercise
WWMCCS	World Wide Military Command and Control System
XO	Executive Officer